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INVESTIGATIONS CONCERNING THE ETIOLOGY OF SMALL-POX.[1]

BY J. CHRISTIAN BAY.

[With plate XXIX.]

The etiology of small-pox is one of the most interesting problems in bacteriology, and has been subject of considerable investigation for thirty years and more. A brief historical sketch, illustrating what has hitherto been done in this line should, naturally, precede this preliminary record of my own work the progress of which may be traced in the Iowa Health Bulletin published by the State Board of Health of Iowa under whose authority these investigations were carried out during the past year.

Numerous writers have investigated the small-pox and vaccine lymph, and some have recognized specific micro-organisms, both animal and vegetable, as the primary cause of the disease, or of the specific eruptions.

One of the micro-organisms, heretofore more or less generally recognized as the effective agent is the *Micrococcus vaccinæ* and *variolæ;* Bareggi who, among others, studied these, states[2]

[1] Published in abstracted form in the Medical News, January 26, 1895. Presented to the Iowa State Board of Health, February, 1895, and read before the Des Moines Academy of Sciences.

[2] Sul microbi specifici del vajuolo, del vaccino e della varicella. Gaz. med. Ital. Lomb. Milano (8) VI, 480, 506, 519, 529, 545; with plate.

that the micro-organisms of small-pox and those of vaccine are identical.[3]

In 1868, Chauveau[4] proved that vaccine virus is deprived of its active substance by filtration. Hence, it became more than probable that the contagion was a living organism, and no gaseous or diffusible product. "For when he carefully poured a stratum of water upon a layer of lymph, in tiny tubes, he obtained a diffusion of the dissolved material into the water, but this clear solution could not produce pustules like the insoluble residue."

In the same year, Hallier[5] described micrococci "of a singular appearance from human small-pox, cow-pox and vaccine eruptions, the diameter of these bacteria being $\frac{1}{300}'''$ to $\frac{1}{150}'''$; they exhibited motion except when covering the lymph-particles.

Previous to this, G. Simon[6] found, in human small-pox, round particles which were insoluble in acetic acid. Salisbury[7] also claimed to have demonstrated a specific small-pox organism which he named *Jos variolosa;* it was described as quite polymorphous; its alga-stage was seen in cow-pox eruptions; "fructification" was reached in small-pox eruptions.

Luginbuehl[8] discovered, in sections cleared with acetic acid micrococci which formed colonies at certain places in the skin, near the epidermis, in cases of small-pox eruptions. Beale[9] found "vast multitude of minute particles of living matter or bioplasm" in the small-pox vesicles, but he did not attribute to these the name of *causa morbi.*

Cohn[10] showed the presence of minute cocci in vaccinia and small-pox lymph; when the lymph is fresh, the cocci were moving freely, propagated themselves by division, and, after

[3] Confer Crookshank, Manual, p. 203; Klein, Micro-Organisms and disease, pp. 79-80.

[4] Comptes Rendus LXVI, 289, 317, 1868.

[5] Aerztl. Intelligenzbl. XV, 75; Virchow's Archiv XLII, 309, 1868.

[6] Müller's Archiv, 1846, 185.

[7] Schmidt's Jahrbücher, 1871.

[8] Verhandl. d. phys. med. Ges. in Würzb. IV, 99, 114; 1873, w. pl.

[9] Disease-germs, their nat. and orig., 1872, 148; pl. XVIII, fig. 64.

[10] Virchow's Archiv LV, 229-238, 1872.

16–32 hours of cultivation, aggregated in masses, afterwards in films the formation of which seemed to be the terminal phase of their life-history.[11] Cohn named this organism *Microsphæria vaccinæ* which was a specific coccus and no representative of some stage of development of some other organism. The name was later changed into *Micrococcus vaccinæ* which Cohn, in his system of bacteriology, described in the following way[12]: "Cells ball-shaped, 0.5–0.75 μ. in diameter, or united two and two or more in chains and masses, also forming a zoogloea. In fresh lymph from cow-pox and small-pox as well as in the pustules in confluent variola."

Weigert, a short time before Cohn, found[13] "vessel-shaped, irregular, often ramified formations of 0.1–0.2 mm. in diameter with granulated, well-marked contents which was not affected by acetic acid, sodium and glycerin. He interpreted these formations as lymphatics filled with bacteria. They were found in the neighborhood of small-pox pustules, and at their edges, where also haemorrhagical herds, and arteries with the same contents were observed. Cohn declared that Weigert's granules were identical with his *Microsphæria*.

Thus it was beyond doubt that vaccinia, cow-pox and variola were caused by attacks of bacteria. Burdon-Sanderson also confirmed this view. The history of the cases also show that the disease is caused not only by a *contagium fixum*, but also by a *contagium halituosum*.

Weigert's observations concerning the lymphatics were repeated and confirmed by Klein.[14]

Klebs[15] set forth the statement that the organism (micrococci) in vaccinia and variola exhibit peculiar physiological and morphological properties. The cells are placed four and four together and assume, ontogenetically, no other shape than that

[11] The same aggregations had been observed by Keber.

[12] Beitr. zur Biol. d. Pflanzen, Vol. I, part II, 161.

[13] Ueber Bakterien in der Pockenhaut. Centralbl. f. d. med. Wiss. IX, 606–611, 1871. Ueber pockenaehnl. Eruptionen in innern Organen. Deutsche Zeitschrift f. prakt. Med. I, 367–369, 1874. Anatom. Beitr. z. Lehre von den Pocken, part I, 1874.

[14] Phil. Trans. Lond., 1874; Micro-Organism and disease, 1886, 69.

[15] Arch. f. experiment. Pathol. und Pharm. X, 222, 1879.

of the coccus. The size of the cell diameter was 0.5 μ. This organism received the name *Microccus quadrigeminus.* The literature on hand does not elucidate whether this bacterium had, by virtue of its characteristics, any diagnostic value.[16]

In 1883, C. Quist found that vaccine lymph could be artifically propagated in various nutritive media,[17] but such a dilution of the lymph had nothing to do with the bacteria, so far as these experiments went. It is undisputable that Quist propagated the vaccine *virus* along with the dilution of the lymph; the preservation of the virus in glycerin and other media, as done by practitioners, is, therefore, in spite of Pfeiffer's views, no simplification of Quist's method, in as much as propagation and preservation of efficacy (life activity) are not absolutely identical. Small-pox is unquestionably a bacterial disease, and we know that bacteria can live without propagating themselves; the ultimum temperature of propogation is lower than that of life, in both directions from zero.

Pfeiffer[18] found, in 1885, a sprouting fungus which he named *Saccharomyces* seu *Cryptokokkus vaccinæ vaccarum.* This fungus is not very much different from the so-called *Saccharomyces apiculatus*, and is no *Saccharomyces*[19], as it belongs to the group *Torula* in the sense of Pasteur and Hansen. In small-pox lymph, I have occasionally met a *Torula* which corresponds to Hansen's fifth species.[20] Pfeiffer's fungus did not bear endospores, and has no causal relation to small-pox. This *Torula* as well as the saprophytic bacteria, and the animalculæ which Pfeiffer reported from pustules will appear in many other eruptions and ulcerations. It appears that some of Pfeiffer's

[16] Conf. Lœffler, Vorles. ueb. d. gesch. Entwickelung der Lehre von den Bakterien I, 132, 1887.

[17] Finska läk. sällsk. handlingar XXV, 271, 1883. XXV, 341, 1883. Berl. klin. Wochenschr., 1883, 811–813. Hygiea (Stockholm) XLVI, 194, 203, 1884. See also Medical News.

[18] Correspondenzblatt d. allgem. aertzl. Vereins von Thüringen., 1885. No. 3. Sep. 12 pp.

[19] See my paper in THE AMERICAN NATURALIST, XXVII, 685–696, 1893.

[20] See Jœrgensen, Micro-Organisms and Fermentation, 1893, p. 190, and Bay, Amer. Monthly Microscop. Journal, XV, 42; 1894.

drawings[21] as well as Beale's "bioplasts (loc. cit.) indicate serious misinterpretations of the microscopic pictures.

L. Voigt described, in 1885,[22] three different forms of cocci from small-pox pustules. All of them would liquefy gelatine, and one of them was considered the probable carrier of the contagion. No definite results were, however, obtained. There were two cocci, and a diplococcus.

Pohl-Pincus also studied the micrococci found in specific eruptions, and showed their passage through the epidermis of a calf after inoculation.[23]

Hlava[24], Bowen and Garré have succeeded in isolating a streptococcus (*Streptococcus pyogenes*). They considered the united attack by these pyogenic cocci the cause of the disease. Koch and Feiler were, however, of the opinion that although some of the saprophytic micro-organisms found in vaccine lymph are pathogenic, they do not carry the contagion.

Protopopoff[25] succeeded in finding a streptococcus which corresponds, both macro- and microscopically, to the descriptions of the *Streptoccocus pyogenes*. Samples from pure cultures were injected in rabbits, dogs and cats, but without effect. Although this does not imply that this organism cannot affect man, it seems improbable that it could have any causal relation to variola.

Crookshank[26] and Copeman[27] found, in vaccine lymph, great numbers of common saprophytic and of some pathogenic bacteria, but no specific organism.

Rille[28] observed cocci in the vesicles and blood of persons suffering from varicella, but did not apply himself to bacteriological studies of these organisms.

[21] Correspondenzblatt d. allg. aerztl. Vereins von Thüringen, 1887, No. 2, Sep. 12 pp. 2 plates. Monatshefte f. prakt. Dermatologie, VI, 1887, No. 10. Sep. 13 pp. 2 pl. Die Protozoen als Krankheitserreger. Jena, 1890.

[22] Deutsche med. Wochenschrift, XI, 895–897, 1885.

[23] Pohl-Pincus, Untersuch. neb. d. Wirkungsweise der Vaccination, 1882.

[24] Sbornik Lékarsky, II, 96–105, 1887. Cblt. f. Bakt. II, 688, 1887.

[25] Zeitschrift für Heilkunde XI, part 2, 1890. Sep. 7 pp.

[26] Transact. Seventh Internat. Congr. of Hyg. and Dermogr. II, 326, 1892.

[27] *Ibidem*, 319–326.

[28] Wiener klinische Wochenschrift, No. 38–39, 1889.

Probably Sternberg was right in stating[29] that the etiology of small-pox is still undetermined. Still, some of the investigations above cited furnish very interesting points which are of value to those who wish to reinvestigate the matter.

Micrococci of different shape and characters are, however, not the only bacteria which have been observed in small-pox and vaccinia. A few statements point towards the presence of other bacteria, namely, bacilli. Crookshank (loc. cit.) mentions that he has found *Bacillus pyocyaneus*, *B. subtilis*, different *Bacterium*-forms (one yellow), and a bacillus resembling *Bacillus subtilis*. Martin[30] has described a bacillus of vaccine lymph. The ends of this bacillus are round or square, and it may form micrococci (!) which are arranged in chains of five or six cells. The author admits the possibility that both a bacillus and a micrococcus were present.

Coze, Feltz and Baudoin[31] have demonstrated the presence of bacilli in the blood of variola; upon injections of this blood into the veins of a rabbit, the typical symptoms of variola were produced.

In sheep-pox lymph examined by Zimmermann[32] three bacilli were found one of which had almost the same appearance as *Bacillus amylobacter*. A second investigation showed the presence of a short-limbed bacillus; *Micrococcus vaccinæ* (or *variolæ*) occurred in both series of investigations. All of Plaut's plates demonstrate bacilli which he was able to cultivate.

Toussaint's studies which also resulted in a discovery of bacilli are mentioned by Plaut (loc. cit.)

In April, 1894, vaccine "points" were procured from Dr. Hewitt's Vaccine Station at Red Wing, Minn. A watery dilution of the lymph adhering to the "point" contained, when examined by 1160 diam. m. (Bausch and Lomb, Oc. C2, Obj. $\frac{1}{12}$ oil imm.) a few amorphous bodies which assume a yellow color with IIKa, a few round bodies and irregular masses (probably nuclei or fragments of cells), dispersed in a clear fluid. I could distinguish no micrococci or other bacteria, and

[29] Manual of Bacteriology, 1892, 528–529.

[30] Boston Med. and Surg. Journal, CXXIX, 589, 1893.

[31] *Fide* Magnin-Sternberg, Bacteria, 1884; 410, 464.

[32] Plaut, Das organisirte Contagium der Schafpocken, 1882; 22.

no staining revealed any living organisms. Some of the round bodies observed in ten different examinations may have been spores or micrococci, but their nature was not revealed by the microscope.

A series of plate cultures upon "Pasteur gelatine"[33] was then arranged, but there occurred no development. These plates were prepared from 10 parts of gelatine to 90 parts of Pasteur's fluid. So, test-tube cultures in Pasteur's fluid alone, and in bouillon (beef; one pound of meat to one liter of water) rendered alkaline by Cl Na. were made. The points were grasped with a forceps, passed through a flame, and dropped into the medium which had been, previously, submitted to a very thorough fractional sterilization, as by the usual preparation of medium supplies. Great care was exerted in order that no infection from without should take place.

By a temperature of 24°C. the culture fluid would, on the next day after inoculation, become slightly turbid; on the second day the turbidity increased, a thin film being formed on the surface, and on the third day a grayish, highly tenacious film made its appearance. Microscopic investigation showed the presence of *bacilli*. The latter are colorless; they exhibit no motion, are devoid of cilia; their long diameter measures 0.6–1.0 μ and the short diameter .2–.3 μ. During the first and second days, they seem to develop in colonies of 20–200 cells, although, under the cover, many cells appear to be free and isolated.

The zooglœa (surface-film) has, to a great extent, the same appearance as the film-growth of the yeast-like *Mycoderma*, being folded, and of a greasy appearance. It is so tenacious that it resists the weight of the column of the culture medium which was observed as one of the cultures chanced to be inverted. Its connection with the culture vessel is quite intimate. On the fourth days, fragments of the zooglœa began to descend to the bottom, and the macroscopic appearance of the culture remained, after this, unaltered for three weeks and more. During this period, however, the microscopic appearance of the bacillus was gradually much modified.

[33] See Salomonsen, Bacteriological Technology, pp. 460 and 464.

This organism was found, with three exceptions, in 65 cultures from vaccine points hitherto made. Buttersack whose recent investigations will be mentioned in due time ventures the supposition that the specific organism of vaccine was not hitherto detected, because of its index of refraction being identical with that of the medium (lymph). I see no reason for this supposition, and I am prepared to explain Buttersack's theory from my own observations.

This bacillus has, to a great extent, the same appearance as those found by Plaut[34] and Zimmermann in sheep-pox.

Already at the beginning of the development, while the medium is well stored with nutrition, *the bacilli* bear spores. This being the most conspicuous feature of the organism, I named it *Dispora variolæ*. The systematic side of the description is as follows:

Genus: DISPORA.

Dispora: Kern, 1882.

Kern (Botanische Zeitung, 1882, No. 16) founded this genus upon one species which was found in kephir and which was characteristic mainly by having two spores in each cell. The genus belonged to the bacillus-group. Kern's *D. caucasica* has not been rediscovered by later students of the kephir-organisms (Beyerinck, M. Ward, Mix), and the genus-name vanished into *Bacillus* (Crookshank, Manual, 312).

Dispora variolæ.

Syn. The spore stage was described under the following names: *Microsphæria vaccinæ* Cohn, *Micrococcus vaccinæ* and *variolæ* Cohn, *Jos variolosa* Salisbury.

Habitat: In vaccine and small-pox lymph constant. Descr. Bacilli 0.6–1.0 μ by 0.2–0.3 μ. Two spores in each cell, one at each end. Aërobic.

On the sixth days of cultivation, *free* spores begin to make their appearance, both in the fluid and in the zooglœa. They are globular, highly refractive, and may be mistaken for what appeared to me, by a little over 2000 d. m., as vacuoles. The

[34] Loc. cit. Beilage I–IV b; especially II a.

latter are, however, larger, and their shape is oval or rectangular.

The same organism was found also in the lymph of variola confluens kindly furnished by the small-pox hospital in Chicago. Out of forty bouillon-cultures made from this lymph, only two failed to show the presence of the *Dispora.*

To prove that *Dispora variolæ* was not accidentally caught in the cultures from the atmosphere, gelatine-plates (10% gel., 90% beef-bouillon) were exposed to the air at the tables and windows for different periods of time. Among the numerous organisms thus obtained, none presented the characteristics of the above named bacillus

When cultures were examined on the eighth day after inoculation, the cells seemed to be crowded together in separate masses, each cell being surrounded by a rather thick layer of a gelatinous mass, free spores being abundant. As the cultures grew older, the cells gradually became more and more lengthened, forming rows, and on the fourteenth and fifteenth days, the culture presented the appearance shown in fig. 4. The cells were lengthened and formed long, thin threads. Spores were abundant, both in the cells and free. The number of cells was now gradually diminished, and, on the thirtieth day, very few were seen, the number of spores being altogether predominating. When traces of this last stage of development were transferred, with the usual precautions, into new medium, development promptly followed, as above described.

The following method of staining gave good results: A small drop of the culture was placed between two covers and slightly pressed between them. The covers being separated in the usual way were placed, moist side upwards, under a bell glass. When some of the fluid had evaporated, the clean side of the covers were placed three times, for a period of about one-second, in the immediate neighborhood of a flame. When completely dried in the temperature of the room, the covers were placed in alcohol for two or three minutes, and again dried; then they were floated, film-side down, upon aniline blue or aniline violet for 24 hours, washed, dried and mounted in the usual way.

While this organism had the appearance of being a specific bacillus-form, I was not thoroughly convinced thereof until I had made a fractional culture in bouillon which resulted in the development of the one form described. The *Micrococcus vaccinæ* I have never found in vaccine or small-pox lymph.

Regarding the polymorphism of this species I can state that I have observed no such swellings at the middle or ends of the long cells in old cultures as Martin (l. c.) noticed in the bacilli found by him, or as Hansen[35] described for acetic bacteria.

From the figures of *Micrococcus vaccinæ* and *variolæ* which I have seen I am inclined to believe that this organism is not specific, but consists of free spores of *Dispora variolæ.* I also believe that the facts in regard to the spread of small-pox, as well as the observations stated above point towards the conclusion that the spores are the main source through which the disease, itself, as well as vaccinia, are reproduced.

The organisms from small-pox and vaccine lymph are morphologically identical. The physiological difference consists mainly in the attenuation of the form found in vaccine lymph, so far as has been hitherto ascertained.

Buttersack[36] published, a short time ago, an account of certain bodies which occurred, constantly, in vaccine lymph, and which may have some relation to vaccinia. He allowed lymph to dry on covers; having fixed the latter to the slides by means of bees-wax, he inspected the film by immersion and observed a net-work of threads wiih small, refractive, round bodies. Landmann[37] and Dräer[38] interpreted Buttersack's discovery as threads of fibrin and other albuminates. I would assume that B. had seen the "thread-stage" of the organism found by me. Having not yet seen B's illustrations, this is a mere supposition.

The diagnostic value of my discovery is yet uncertain. I hope to be able to report upon the progress of the work, especially concerning inoculations upon animals and the prepara-

[35] Comp. Rend. Laboratoire de Carlsberg III, 265–327, 1894.

[36] Arbeiten a. d. Kais. Gesundheitsamte IX, 96–110, 1894.

[37] Hygienische Rundschau, 1894, 433–34.

[38] Centralblatt f. Bakt. und Parasitenkunde XVI, 561–564, 1894.

tion of vaccine in the laboratory, at some future time, when the work now in progress, has reached completion.

Bacteriological Laboratory, State Board of Health. Des Moines, Iowa, February, 1895.

Explanation of Plate XXIX.

Fig. 1. $\frac{1000}{1}$. *Dispora variolæ,* two days old growth in Pasteur's fluid.

Fig. 2. $\frac{1000}{1}$. Same; four days old. Specimen from surface film.

Fig. 3. ca. $\frac{1500}{1}$. Same; eight days old culture in bouillon. A few spore-bearing cells.

Fig. 4. ca. $\frac{1500}{1}$. Same; eleven days old culture in bouillon. Spore-bearing cells numerous.

Fig. 5. $\frac{1000}{1}$. Same; 25 days old bouillon-culture. Some free spores; chains.

Fig. 6. $\frac{600}{1}$. Same; one month old bouillon-culture. Cells almost disappeared; free spores in excessive numbers.

THE AFFINITIES OF THE LEPIDOPTEROUS WING.

By Vernon L. Kellogg.

It has long been recognized that the venation of the wings of the Trichoptera and Lepidoptera is of similar general character; and recognized, too, although less popularly, that the genera *Hepialus* and *Micropteryx* display more clearly than do any other lepidopterous forms this general resemblance to the trichopterous venation. Speyer,[1] in 1870, pointed this out in his discussion of the affinities of the Lepidoptera and the Phryganidæ. His too serious consideration of the many mere analogies apparent in any comparison of the groups did much

[1] Speyer, A. Ueber die Genealogie der Schmetterlinge, Stettiner Entomologische Zeitung, pp. 202–223, 1870.

to discredit the real points of worth brought out in his discussion. In the light, however, of the present association of *Hepialus* and *Micropteryx* as a sub-order, the *Jugatæ,* of the *Lepidoptera,* which is recognized as a distinctly more generalized group than the sub-order *Frenatæ,* which includes all other Lepidoptera, this trichopterous character of the jugate venation becomes more conspicuously significant.

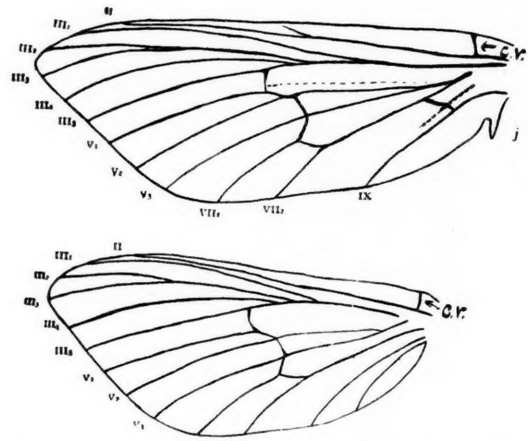

FIG 1 Wings of *Hepialus humuli;* *c. v.*, cross vein; *j.*, jugum.

Hepialus[2] (see Fig. 1) and *Micropteryx* (see Fig. 2) are distinguished in point of venation[3] from the Frenatæ (see Fig. 3) by the fact that the radial area of the hind wings is not reduced, although the anal area is, thus causing a similarity in venation between the fore and hind wings, radius (III) being five-branched in each. This similarity of the venation of both wings is not to be found among the Frenatæ. The persist-

[2] The venational nomenclature used is that of Redtenbacher (Vergleichende Studien über das Flügelgeäder der Insekten, in Annalen der k. k. naturhistorischen Hofmuseums, Bd. I, 1886, Wien) adopted, with modifications, by Comstock.

[3] The real value of these taxonomic characters presented by the venation of the Lepidoptera can be fully appreciated after a reading of Prof. Comstock's essay on Evolution and Taxonomy; in the Wilder Quarter-Century Book, 1893, Ithaca, N. Y.

ence of the stem of media (V) anywhere among the Lepidoptera is an indication of a generalized condition, as is the persistence of more than two anal veins in the hind wings. At the base of the principal descent lines of moths are found generalized forms, their generalization indicated in their venation by the persistence of media (V) and often by the presence of three anal veins in the hind wings. But the specializing ten-

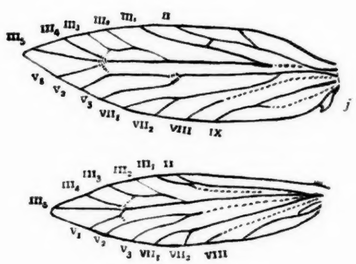

FIG. 2. Wings of *Micropteryx* sp.; *j.* jugum. (After Comstock).

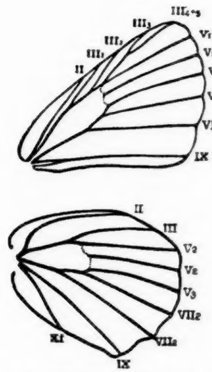

FIG. 3. Wings of *Chrysophanus thoe*. (After Comstock).

dency towards a cephalization of flight, resulting in a change from the racial sub-equality and importance of fore and hind wings to an inequality produced by a reduction of the hind wings has resulted in the loss (coalescence) among all living Lepidoptera, except the genera *Hepialus* and *Micropteryx*, of the branches of radius in the hind wings.

As pointed out by Prof. Comstock, the Jugatæ (*Hepialus* and *Micropteryx*) in this respect stand much nearer the racial lepidopteron than do any of the Frenatæ. The striking resemblance, then, of the jugate venation, standing, as it does, for the most generalized existing condition of lepidopterous venation, to the trichopterous type of venation is significant. By an inspection of the figures, herewith presented, of the venation of *Hepialus* (see Fig. 1) and *Micropteryx* (see Fig. 2) with those of the venation of *Neuronia* sp. (see Fig. 4) and of an undetermined

caddice-fly collected by me in Colorado (see Fig. 5), the reality of the correspondence is apparent. In the fore wings of all the simple unbranched sub-costa (II), the 5-branched radius (III_1–III_5), the persisting stem of media (V) coalescing at its base with cubitus (VII), the three branches (four in the Colorado trichopteron) of media (V), and the reduced anal field, are common characters. In the hind wings, the general character of the venational uniformity is only varied by differences which,

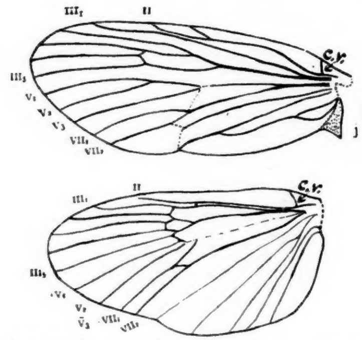

FIG. 4. Wings of *Neuronia*, sp.; *c. v.*, cross vein; *j.* jugum.

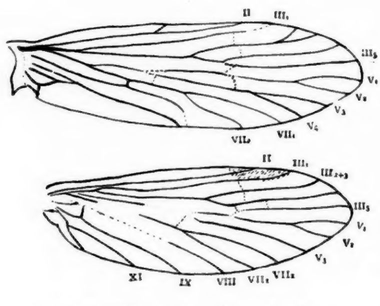

FIG. 5. Wings of undetermined caddice-fly; *j.* jugum.

in themselves, are additional evidences of a community of plan. One of the caddice-flies differs from the other in those correlated characters which have been pointed out by Prof. Comstock as characteristic of the tendency of specialization in the lepidopterous wing, viz., a tendency towards the coalescence (or disappearance) of the radial branches and increasing reduction of the anal area manifested by a loss of anal veins. In the hind wings of the Colorado caddice-fly (see Fig. 5) there are but four radial branches (III_1, $III_{2,3}$, and III_4 and III_5), and the anal veins (VIII, IX, XI, XIII), while two more in number than in *Micropteryx* or *Hepialus*, are less in number than in *Neuronia*.

It is beyond the scope of this paper to attempt any discussion of the lines of specialization exhibited by the wings of the Trichoptera, but it is an obvious and interesting fact that the

general characters of these lines are strikingly parallel with those exhibited by the Lepidoptera. A more primitive subequality of the wings, shown among the Lepidoptera only by the Jugatæ, is retained, but there is an obvious tendency towards a narrowing of the wings and consequent loss in number of veins, this loss being first apparent among the anal veins, and radial branches, and the hind wings being the first to be reduced. *Setodes* and other similar forms constitute an exception to this general tendency, something as do the Saturniina among the Lepidoptera, in that a peculiarly expanded anal field is displayed, although the venation of the wing is considerably specialized, the radial branches being largely reduced. The wing and anal area here are not in a primitive condition, but display a peculiar sidewise developed specialization. The tendency towards the disappearance of the base of media (V) is manifest, the stem of the vein in both fore and hind wings of *Mystacides punctatus* and others being represented by a mere fold.

Of interest in the comparison of the trichopterous and jugate wings, is the condition of the cross veins. The primitive neuropterous wings are characterized by the wealth of cross veins; the specialized lepidopterous wings are characterized by the almost total absence of these veins. The Jugatæ show more cross veins than do any of the Frenatæ. The usual trichopterous wings possess more cross veins than the jugate wing, but the manifest tendency is towards their fading out and disappearance. The wings of *Mystacides punctatus*, for example, a highly specialized trichopteron, shows fewer cross veins than do the wings of *Hepialus* or *Micropteryx*. In the hind wings of *Setodes* sp. there are no cross veins and but two or three in the fore wings. In the disappearance of the cross veins those midway between base and apex of wing persist longest; although there is a cross vein between the basal part of subcosta (II) and the costal margin of wing which is very persistent (see *c*.

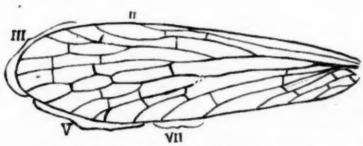

FIG. 6. Fore wing of *Panorpa* sp.

v. in *Hepialus humuli* Fig. 1, and in *Neuronia*, Fig. 4). I present a figure of the venation of the fore wing of *Panorpa* sp. which should be examined in connection with the jugate and trichopterous wings for the noting of this tendency of disappearance of the cross veins, and for the persistence of the mid-wing cross veins. It is worth while, in passing, to note also the general agreement in venational character of the mecopterous wing with the trichopterous and lepidopterous wings. The more generalized character of the *Panorpa* wing is manifest in the point of number of radial and medial branches and in the abundance of cross veins. As I have pointed out elsewhere, this disappearance of cross veins in these three groups proceeds coincidently with the development of the wing-scales, which serve to strengthen the wing-membrane.

Not alone in character of venation but in character of wing-clothing, as pointed out in a previous paper,[4] and in the mode of tying the fore and hind wings of each side together for the sake of sychronity of movement in flight, do the jugate and trichopterous wings show obvious resemblances. The well-known scale-hairs of the Trichoptera are simply the true lepidopterous scale in generalized state. Nor are these trichopterous scales always of so generalized condition as an examination of a limited number of wings might lead one to believe. There are many instances among the caddice-flies of the presence of well developed scales. In Fig. 7 well-specialized scales from the fore wings of two species of *Setodes* are shown at *c* and *d*. I have been specially interested to note in the wing clothing of *Mystacides punctatus* (see *a* and *b*, Fig. 7) in addition to the numerous broad scale hairs, a sprinkling of conspicuous large, flattened, bulbous, white scales, which present externally the peculiar characters of the variously modified scent-scales or androconia of the male butterflies.

The essential structural difference between the Jugatæ and Frenatæ on which the two groups were separated by Prof. Comstock is that displayed by the two methods of uniting the wings of each side during flight. The jugate moths have fore

[4] Author. The Classification of the Lepidoptera, AMERICAN NATURALIST, v. XXIX, no. 339, pp. 248–257, March, 1895.

and hind wings united by a membranous lobe, the jugum, borne at the base of the inner margin of the fore wings. When the wings of *Hepialus* or *Micropteryx* are extended, "the jugum projects back beneath the costal border of the hind wing, which, being overlapped by the more distal portion of the inner margin of the fore wing, is thus held between the two as in a vise." The frenate Lepidoptera have the two wings of each side united by the familiarly known frenulum borne at the base of the costal margin of the hind wings, or by a substitute for a frenulum, an expanded humeral area of the hind wings, by which a considerable overlapping of the wings is produced.

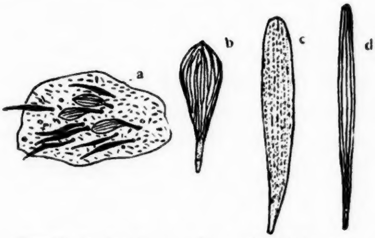

FIG. 7. Scales from wings of Trichoptera; *a*, portion of fore wing of *Mystacides punctatus* showing scale hairs and bulbous, androconia-like scales; *b*, one of the androconia enlarged; *c*, *d*, scales from fore wings of *Setodes*.

The common occurrence of a jugum among caddice-flies (see *j* in Figs. 4 and 5), which is essentially the same structure presented by the jugate moths, has already been referred to by Prof. Comstock as of interesting significance. The jugate method is, however, by no means the only mode of wing union among the Trichoptera. The jugum may exist coincidently with other uniting structures, or it may be entirely wanting, the tying together of the fore and hind wings being accomplished by the overlapping for a considerable space of the hind margin of the fore wing and the costal margin of the hind wing, or by a row of hooks projecting from the costal margin of the hind wing which fasten to a chitinized ridge running along near the hind margin of the fore wing. There seems even to exist the beginnings of the frenate method of wing tying, as displayed in *Hallesus* sp. The wings of this trichopteron present a combination of the jugate and row-of-hooks methods of wing tying, and, in addition, there are present on the base of the costal margin of the hind wing two long strong hairs (see *f*, Fig. 8), the very counterpart of the generalized

frenulum (i. e., frenulum in which the hairs are not united into one single strong spine) of the lepidopterous wing. This trichopterous frenulum is, however, much shorter than the lepidopterous frenulum and does not fit into a frenulum hook on the under surface of the fore wing, but merely rests against the jugum of the fore wing. The jugum is fairly well developed but can hardly overlap the base of the hind wing much. The series of tying hooks extends along the costal margin from near the base of the wing for about one-third the length of the margin. I have figured the method of wing tying for another species (see Fig. 9) which, however, illustrates the method and the functioning structures quite as truly for *Hallesus* sp. In the species figured, the hooks method, combined with the overlapping of the opposed margins of the wings, is the only means of union, the small, jugum-like structure at the base of the fore wing being practically functionless. When the wings are extended a narrow space along the inner margin of the fore wing, roughened on its under surface by many short, strong, sharp-pointed bristles, and with the membrane greatly strengthened and made less yielding by these bristles, is underlain by the costal margin of the hind wing for a distance of more than half the length of the margin. Along the extreme costal border of this underlying space, which is slightly expanded costal-wards, there is a regular series of strong, hooked hairs or bristles, each of which bears on the concave surface of the curved or hooked portion many fine teeth (see *c*, Fig. 9). These toothed hooks are applied to and firmly grasp a strong, roughened, chitinous line or ridge running along the under side of the fore wing. This chitinous line is roughened by the presence of fine ridges for the firmer grasping of the hooks. By the overlapping and hooking there is formed an effective tying together of the two wings.

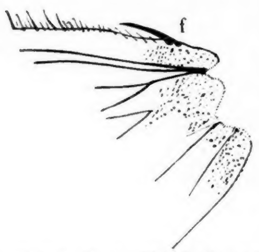

FIG. 8. Base of hind wing of *Hallesus* sp.; *f*, frenulum hairs.

This method of tying by hooks is a common one among the caddice-flies. Often there will be no chitinized ridge (chiefly produced by an extra thickening of one or more of the anal veins) for the hooks to grasp, but one of the anal veins will bear a series of stiff hairs or bristles which interlace with the hooked bristles and project in such a direction that they are effectually grasped by them. In connection with the hooks and slight overlapping of the wing margins, there is usually a well-developed jugum, which makes a firm overlapping connection between the bases of the wings. There are often, too, small bunches of strong, long hairs, or smaller number of still stronger hairs borne on the base of the costal margin of the fore wing, which project forward under the jugum, suggesting, as shown especially in *Hallesus*, the beginnings of the lepidopterous frenulum.

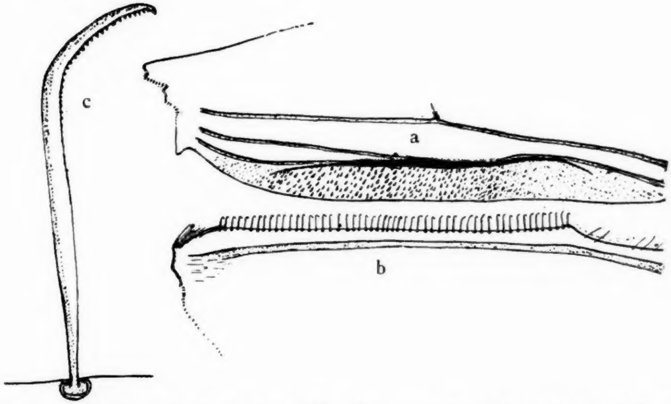

FIG. 9. Portions of wings of a caddice-fly; *a*, anal margin and area of fore wing; *b*, basal half of costal margin and area of hind wing; *c*, hook (enlarged) from costal margin of hind wing.

A most interesting wing tying arrangement is presented by *Panorpa* (see Fig. 10, *a*, *b*, *c*). We have here an arrangement which is strongly suggestive of what that racial type-structure may have been from which, on the one hand, the successfully functioning unaided jugum, and on the other, the perfected frenate arrangement could have been developed. The pretty

strongly developed jugum in this mecopterous form bears on its free margin four strong backward projecting bristles, while a basal expansion of the costal margin of the hind wing bears on its free margin four strong backward projecting bristles, while a basal expansion of the costal margin of the hind wing bears two long, strong, slightly diverging bristles, so projecting that one lies above the other. When the wings are expanded the four jugal bristles lie between two bristles of the hind wing (see *c*, Fig. 10), forming a unique tying arrangement.

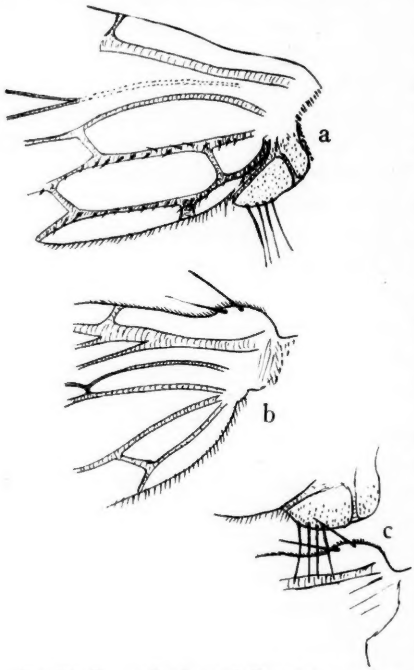

FIG. 10. Bases of wings of *Panorpa*; *a*, base of fore wing; *b*, base of hind wing; *c*, bases of both wings united.

So far as this organ is concerned, and for that matter, so far as concerns the venation and the wing clothing, the trichopterous wing, and the jugate and frenate types of the lepidopterous wing may all have had a generalized prototype very like the mecopterous wing. In the beginning the wings were independent and obviously the frenate type and the jugate type may have arisen, as suggested by Prof. Comstock, as distinct lines from the un-united wing type. But from the known phyletic relations of the Jugatæ and Frenatæ, and from the conditions presented by the trichopterous and mecopterous wings, which I have here attempted to indicate, the evidence, though as yet most ill-digisted, suggests strongly, to my mind, the probability of the

origin of the frenate type from an earlier type which was essentially jugate, but which possessed frenulum-like structures of a character to be easily developed, by selection, into the existing highly specialized frenate condition of the wings of the Noctuidæ and others.

In conclusion, I may add that every attempt I have yet made to study, in a comparative way, the morphology of the three insect groups mentioned in this paper, has afforded in each succeeding instance stronger basis for a belief in the close phyletic relationship of the groups, a belief shared with, of course, and already expressed by many others.

Stanford University, Calif.

ON THE PRESENCE OF FLUORINE AS A TEST FOR THE FOSSILIZATION OF ANIMAL BONES.

By Dr. Thomas Wilson.

(*Continued from page 456, Vol. XXIX*).

Appreciating the importance of the discoveries made in France in regard to the proportion of fluorine in animal bones as a test of their fossilization and antiquity, I determined to make a further attempt in the investigation by analysis of the bones, human and mylodon, found by Dr. Dickeson at Natchez, as heretofore described (page 303). To that end, I made application to Dr. Samuel G. Dixon, Curator of the Academy of Natural Sciences of Philadelphia, for specimens of the two bones to be subjected to analysis with a view to the determination of their respective proportions of fluorine. Dr. Dixon kindly presented my application, and it was allowed. In due course I received the fragments from the two respective bones. Professor R. L. Packard was engaged in the laboratory in the U. S. National Museum making a series of mineral and rock analyses, we had, together, become acquainted with Mons. Car-

not's methods of analysis by having read and studied them, and he was heartily enlisted in the investigation, therefore was chosen to make the analyses. His report is herewith presented:—

WASHINGTON, D. C., March 20, 1895.

Dr. Thomas Wilson, Curator, Department of Prehistoric Anthropology, Smithsonian Institution.

DEAR SIR: I send you herewith the results of the chemical analyses of the fragments of bones you gave me for examination.

One of the specimens, said to be a portion of the mylodon gave on complete analysis the following composition:

Moisture, ...	3.94
Organic matter, ...	25.55
Carbonic acid (CO_2), ...	3.76
Lime (Ca O), ...	28.25
Magnesia (MgO), ...	.06
Manganese (MnO), ...	.79
Oxide of Iron and Alumina (Fe_2O_3 & Al_2O_3), . .	7.75
Phosphoric acid (P_2O_5), ...	26.59
Fluorine (Fl), ...	.28
Insoluble matter, ...	1.55
	98.51

From the nature of the case the determinations were made on different pieces of bone, and its composition seems to be tolerably uniform, because duplicate determinations of moisture, carbonic acid and organic matter varied very little.

Arranged to show the combination of the above bases and acids, for which a separate determination of the iron (and alumina) phosphate were made, the result is:—

Moisture, ...	3.94
Organic matter, ...	25.55
Calcium carbonate, ...	8.54
Calcium phosphate, ...	42.83
Iron (and alumina) phosphate, ...	12.07

Magnesium phosphate, ...	.13
Calcium fluoride, ...	.57
	93.63

The specimen said to be fragments of the human pelvis consisted of a disk of perhaps an inch in diameter and a quarter of an inch thick, pieces of what appeared to have been another disk similar to the first, and a quantity of coarse powder. That the two were not identical in composition is evident from the difference in the loss on ignition, the solid pieces having given 25.05 and the powder 14.20 per cent.

As the determination of fluorine was a special object in this investigation, I decided to use only the solid pieces of the bone, as this would afford a better means of comparison with the mylodon bone. This was accordingly done, and the following was the result of the partial analysis which was carried out on the same sample in which the fluorine was determined :

Moisture, ...	3.62	
Organic matter, ...	21.43	
Iron (and alumina) phosphate, . .	13.01	
Lime (Ca O), ...	27.94	
Phosphoric acid (P_2O_5), ...	20.77	
Fluorine, ...	.38	(=.78 Ca F_2)

It was impossible to determine the carbonic acid. The insoluble residue was slight, but was not determined.

Deducting the moisture and organic matter, we should get for the composition of the ash of the mylodon :—

Calcium carbonate, ...	13.14
Calcium phosphate, ...	65.92
Iron (and alumina) phosphate, ...	18.57
Calcium fluoride, ...	.88

We have not sufficient data for making a similar complete calculation in the case of the human bone, but we can give

enough of the constituents to find in it, as well as in the mylodon bone, the ratio between the fluorine contained in the bones and the theoretical quantity which an apatite having the same proportion of phosphoric acid would contain, as recommended by M. Carnot in the Ann. des Mines, 1893.

Deducting the moisture and organic matter, therefore, we should have the following partial composition of the ash of the human bone:—

Iron (and alumina) phosphate,	17.34
Lime (Ca O),	37.25
Total phosphoric acid,	27.69
Fl (fluorine),	0.51
Or Ca Fl (calcium fluoride),	1.03

The analyses are here re-arranged so as to permit of comparison with those tabulated by M. Carnot:—

Ash	Organic matter	Oxide of Iron (and alumina)	Phosphoric acid	Fluorine	Fluorine of apatite	Ratio { Fluorine and Fluorine of Apatite }
Mylodon	22.55	7.75	26.59	0.28	2.37	0.12
Human bone	21.43	6.50	20.77	0.38	1.85	0.20

In the present instance the fluorine was determined by the method recommended by M. Carnot with no essential modifications. This method differs from others mainly in the composition of the precipitate produced. The process, in brief, consists in decomposing the substance mixed with silica (free from fluorine) with concentrated sulphuric acid which has been freed from fluorine by heating with silica, passing the silicon fluoride gas evolved through dry tubes unto a solution of fluoride of potassium, and precipitating the fluo-silicate of

potassium so produced with alcohol, which precipitate is collected on a tared filter dried and weighed. The decomposition is effected in a dry flask at a temperature of about 100° C and the current of dry air is passed through the apparatus during the operation, which lasts a couple of hours or more. I examined the precipitates under the microscope in order to be certain of their character, and observed the small isometric forms—combinations of cubes and octahedrons—under which silicofluoride of potassium appears.

The analyses of the human bone and mylodon which you had made formerly and have handed me, show that the specimens differed in several respects from those you furnished me. The composition of the mylodon bone does not vary so very much in its essential constituents from that I have analyzed, but the human bone contained 22.59 per cent. of silica. Deducting that figure from the total, and recalculating, we have:

Loss on ignition, ...	20.15
Lime, ...	33.59
Phosphoric acid, ...	22.57

This makes the proportion of lime about six per cent. greater than in the specimen I analyzed, while the phosphoric acid is only some two per cent. higher. In both cases that latter constituent is present in much smaller proportion than is usually given for phosphoric acid in human bones. (See Fremy, Encyclopedie Chimique T. IX, p. 603, where phosphoric acid is as high as 53 per cent. of the ash or total mineral matter). Moreover, the percentage of ash is higher than is usual in human bones. A list in Watts' Dictionary, article Bone, gives the percentage of ash in such bones as below 70 per cent., ranging from about 50 to 70, while in the present case the ash is about 75 per cent.

I am

Very truly yours,

(Signed) R. L. PACKARD.

It is always to be remembered throughout this paper, both in the investigations of myself and Dr Packard, as well as in

those of Mons. Carnot, that the results are comparative and not absolute. The value of our investigations lies in showing that if the bones of the mylodon and the man were originally deposited together, and were practically the same age, they must have been subjected to substantially the same chemical influences, they would show practically the same analyses, and the comparison between their respective constituents should be substantially the same. Thus is afforded the great desiderata of a means of comparison between the human and the animal bone. As it is known that the mylodon was to a certain extent an ancient animal, if the human bone, when compared with that of the mylodon showed an equal amount of fluorine together with the concomitants of fossilization, it is evidence that they are of the same antiquity.

The relations between the various chemical constituents of the two bones are shown in the following table:

	Mylodon	Man
Fluorine, ...	0.28	0.38
Fluorine calculated for apatite, .	2.37	1.85
Ratio, ...	0.102	0.205
Phosphoric acid, ...	26.59	20.77
Fluorine, ...	0.28	0.38
Ratio, ...	94.96	54.70
Organic matter, ...	25.55	21.43
Oxide of iron and alumina, . .	7.75	6.50

From these tables the following comparisons may be made: The fluorine in the mylodon was 0.28, in man 0.38, the ratio between the quantity of fluorine in the bone and to that of an apatite having an equal amount of phosphoric acid was, for the mylodon 0.102, for the man 0.205. A reference to the tables on pages 313 and 447 will show that for modern bones, the average as calculated from twelve specimens, is 0.058. By the same table the Quaternary bones were shown to be 0.36. It would appear from a comparison, that the bones of the man and the mylodon subjects of the present analyses are approximately between modern bones and those of the Quaternary period.

In the present cases the phosphoric acid was in the mylodon 26.59 and the man 20.77, while the fluorine was respectively 0.28 and 0.38, making the ratio between them, for the mylodon 94.96, for the man 54.70. Referring to page 455, we will see this test applied to the discoveries of Billancourt. There the two fossil bones were respectively 23.9 and 19.4, while the human bone reached the high average of 168.9. Turning again to the table on page 447, we will see that this ratio was increased in the case of bones known to be modern to 193.1. This, therefore, bears out the contention of the value of this test—it shows two things, (1) that according to the averages made by Mons. Carnot, the bones under present consideration, the man and the mylodon, are substantially of the same antiquity, and (2) by the same comparison their antiquity is about midway between the modern bones and those of the Quaternary geologic epoch.

This investigation will be carried further by making analyses of other bones, some of which will be modern, some of known, and others of supposed antiquity.

CONTRIBUTIONS TO COCCIDOLOGY.—I.

By T. D. A. Cockerell,

ENTOMOLOGIST, NEW MEXICO AGR. EXP. STATION.

The present is the first of a proposed series of papers on Coccidæ (Scale Insects); intended to make known some of the numerous new facts, especially regarding their distribution, which are constantly coming to light. The ever increasing traffic in living plants, which is going on in nearly every part of the world, is leading to the wide dispersal of injurious Coccidæ. No one who has not given particular attention to this matter can realize the serious nature of the situation, from an economic point of view. Not only is the number of harmful Coccidæ in each locality being greatly increased by importations, but, as is well-known, the imported species often show a

marked tendency to become more destructive than in their native habitat.

If the naturalist, pure and simple, on reading these lines should say that the matter does not concern him, but the horticulturist, he is begged to remember the bearing of these changes on questions of geographical distribution. If, ignorant of what is going on through man's energy, he proceeds to collect Coccidæ and argue about their distribution, he will arrive at the most extraordinary conclusions, and will, perhaps, be asking for sunken continents to explain phenomena which had no existence twenty-five years ago!

The notes given will be placed under sub-heads indicating the several countries, states or districts. Species marked * are new to the region indicated by the sub-head. This merely means that they are first found there, whether on wild or cultivated plants, out of doors or in hothouses. But native and introduced species will not be placed under the same sub-head if it can be avoided; when we do not know whether a species is native or not, it will be assumed for the present to be so. (N.)=native. (I.)=introduced.

With reference to food plants the following abbreviations will be used: (n. p.)=new food plant; (n. g. p.)=new genus of food plants; (n. o. p.)=new natural order of food plants. Coll. =collected by; com.=communicated by; cp.=compare; used in indicating useful references.

Types of all new species described will become the property of the U. S. National Museum.

Antigua, West Indies.

While we have no positive information to guide us, I believe the following species have been introduced. They were all coll. Mr. Barber, Superintendent of Agriculture of the Leeward Institute (cp. Ins. Life, VI, 50–51.)

Aspidiotus destructor Signoret. On leaves of banana at Clare Hall; also on cocoanut, Jan. 15, 1895.

Aspidiotus personatus Comst. A few on rose leaves, and many on *Ficus* sp. near *benjamina* (cp. Jn. Inst., Jamaica, 1892, 54). This is the fifth *Aspidiotus* found on rose, the others being *A. fiscus*, *A. articulatus*, *A. dictyospermi* var. *jamaicensis*, and *A. perniciosus*.

**Ceroplastes floridensis* Comst. Several on fern leaves (n. o. p., but cp. supposed *C. vinsoni*, in Timehri, Dec., 1889, p. 309, fig. 3). The fifth *Ceroplastes* found in Antigua.

Lecanium hemisphæricum Targ. A few on fern leaves (cp. Bull. Bot. Dep. Jamaica, 1894, p. 71).

Lecanium oleæ (Bern.). Brown variety. One on fern leaf. (Also found on leaves of a fern in hothouse, Denver, Colo., by Prof. Gillette, the fern in this case being *Platycerium alcicorne*).

TRINIDAD, WEST INDIES.

The first two are certainly, I think, native; the third probably native, the fourth certainly introduced. All were coll. Mr. J. H. Hart in 1895.

**Icerya rosæ* Riley & Howard. Sent in quantity, from the base of a tree of *Amherstia nobilis*, "covered up by small caverns of earth by a species of small ant that no doubt was interested in so doing. The scale was not perceived above ground at all, but on the roots there were plenty of several sizes." (Hart in litt.) This was on Jan. 26.

Vinsonia stellifera (Westw.). On *Stanhopea* (n. g. p.). "Fairly common here but causes little trouble." (Hart in litt.) There appear to be good reasons for believing that this is properly a neotropical species.

Otheria insignis Dougl. In numbers on leaves of lime (n. p.), "quite a pest." (Hart in litt.) (Also found by Professor Townsend on lime and orange in Mexieo, as will be set forth in a report shortly to be issued. The insect is to be dreaded as a pest of *Citrus* fruits in the warmer parts of the U. S.; already it is well known in this country as a greenhouse species (cp. Mr. Lounsbury's paper, lately sent out from the Amherst, Mass., College), and may very easily be transferred thence to out-of-door plants in the South. In Ceylon it has also appeared, and Mr. E. E. Green has found the true ♂—the presumed ♂ of this species, found by Douglas and Lounsbury, being apparently those of *Dactylopius*. It is hard to explain why the true ♂ (with caudal tuft) has not been seen in America, unless it is that the insect reproduces parthenogenetically with us. It may here be remarked that *Ortheria edwardsii* Ashmead, described only from the ♂, is pretty clearly no *Ortheria*.

Chionaspis citri Comst. "Is the pest of our lime trees here." (Hart in litt.) This extremely pernicious species has not yet spread generally through the West Indies, being still unknown, for example, in Jamaica.

COLORADO (I.).

The following species have lately been sent to me from Colorado hothouses by Prof. Gillette. I refrain from giving details as Prof. Gillette will shortly publish the full records in a paper on the Hemiptera of Colorado.

*(1.) In greenhouse at Fort Collins: *Lecanium hesperidum* (L.), *Aspidiotus nerii* (Bouché), *A. dictyospermi* Morg., *A. rapax* Comst.

*(2.) In greenhouse at Denver: *Lecanium oleæ* (Bern.), *L. longulum* Dougl., *L. hemisphæricum* Targ., *L. perforatum* Newst., *Aspidiotus ficus* (Ashm.), *A. dictyospermi* Morg., *Aulacaspis boisduvalii* (Sign.).

(Thus, ten species between the two hothouses! The *A. dictyospermi* is a species originally from Demerara; I found it last year on a palm in Mr. Boyle's hothouse at Santa Fe, New Mexico. *A. rapax* is the *camelliæ* of Signoret, but hardly that of Boisduval, vide Morgan, Ent. Mo. Mag., 1889, p. 351. Since Signoret intended no new species, but only Boisduval's, by his name *camelliæ*, it is apparent that the name proposed by Comstock has a right to stand.)

It may be here added that Prof. Gillette also sent me *Aspidiotus perniciosus* Comst., found on pears purchased (but not raised) in Fort Collins, Colorado.

NEW MEXICO (N.).

Lecaniodiaspis yuccæ Twns. I have lately found several of this species on Little Mountain, Mesilla Valley, living on *Parthenium incanum* (n. o. p.) mixed with *Tachardia cornuta* Ckll.

Coccus confusus Ckll. Mr. A. Holt has found this close to the Agricultural College, on *Opuntia leptocaulis* DC. (n. p,), the plant determined for me by Prof. Wooton. (At Tucson, Arizona, Prof. Toumey finds *C. confusus* on *Opuntia versicolor* Engelm.)

**Dactylopius solani* var. nov. *atriplicis*. On *Atriplex canescens* close to the Agricultural College, Sept., 1894, living on the twigs and branches.

♀. Size of *D. citri*; pale greenish, sparsely mealy, no lateral processes; forming no ovisac, but a cushion of white cottony matter, in which are seen lively young.

Mr. Joseph Bennett, who was a student of the college at the time of the discovery of this insect, prepared specimens of the ♀, and drew up the following description:

"Derm clear transparent. Form oval, slightly obovate. Leg: coxa rather short, about as broad as long; trochanter rather large, about half as long as coxa and two-thirds as broad as long; femur about one and a half times as long as coxa, and about two-thirds as broad as coxa; tibia about as long as femur, and half as thick; tarsus two-fifths as long as tibia and very near as thick, tapering to half as thick, claw very small. Anal ring with six hairs. Antenna 8-jointed; 1 short and thick, 2 about as long as 1, 3 much longer than 2; 4, 5, 6 about equal in length, about one-third as long as 3 and same thickness; 7 a little longer than 6; 8 as long as 3+4. Formula 83 (21) 7 (654). Each joint emits numerous hairs, those on final joint being longest." (J. Bennett.)

♂. Mr. Bennett had the good fortune to find the ♂, of which I noted the following characters:

Very small, about 1 mm. long, dark sage-green or greenish-gray, legs and antennæ brownish; caudal filaments only about as long as abdomen, thick, snow-white from secretion; wings semitransparent milky-white.

The typical *D. solani* lives on the roots of *solanum* underground; and differs from the var. *atriplicis* in lacking the greenish color, and in the second joint of the antennæ being somewhat longer than the third. (The typical *D. solani*, hitherto known only from New Mexico, is to be added to the fauna of Colorado, having been found on roots of *Solanum rostratum* (n. p.) at Fort Collins, coll. C. F. Baker, com. Gillette. Found originally on potatoes grown in the Mesilla Valley, it was not feared as a potato pest, since the potato is not grown as a regular crop. It may, however, prove quite otherwise at

Fort Collins, where, I understand from Prof. Gillette, the potato is one of the leading crops. Yet it is probable that the disturbance of the land in the cultivation of potatoes would prevent the over-abundance of *D. solani.*)

Atriplex canescens has proved a mine of wealth to the coccidologist. The following species are found on it in the Mesilla Valley, n. m.: *Dactylopius solani* var. *artriplicis* Ckll., *Lecaniodiaspis* (*Prosopophora*) *yuccæ* var. *rufescens* (Ckll.), *Ortheria annæ* Ckll., *Mytilaspis albus* var. *concolor* Ckll., *Ceroplastes irregularis* Ckll.

**Ortheria nigrocincta* n. sp. On narrow leaves, apparently of a species of Compositæ, Gila Hot Springs, N. M., July 20, 1894, coll. C. H. T. Townsend. When Prof. Townsend gave me this insect, I supposed it was only *O. annæ,* but a careful comparison reveals the following good distinctive characters:

♀. Length, with ovisac, 4 mm., breadth 2 mm.; ovisac pure chalk-white, firmer than in *annæ,* longitudinally ridged above. Body (dried) coal-black, legs dark brown, antennæ reddish-brown. Sides, between dorsal and lateral lamellæ, broadly black from the exposed body, Anterior dorsal lamellæ broader antero-posteriorly than in *annæ.* Posterior lamellæ much as in *annæ,* free from ovisac, but not so rapidly increasing in length mesad; the innermost one not being greatly longer than the outermost.

Another allied species is *O. sonorensis,* which will be described in Prof. Townsend's report on his recent trip in Mexico. The following table will separate the three:

A. Length with ovisac over 5 mm.
  1. Posterior lamellæ about equal in length; a small portion of hind-dorsum free from secretion, *sonorensis* Ckll.
  2. Posterior lamellæ successively longer mesad, the innermost at least twice as long as the outermost; dorsum covered by secretion, *annæ* Ckll.

B. Length with ovisac under 5 mm., sides of dorsum naked, *nigrocincta* Ckll.

**Chionaspis pinifolii* (Fitch). Last December I found this scale on some pine branches brought from the Organ Mountains. (It is doubtless native on the pines of the Rocky Moun-

tain region. Prof. Gillette has found it at Manitou, Colorado; the specimens from this locality vary, some having the exuviæ very pale yellow, as in examples found by Mr. Petit at Ithaca, N. Y., while others, constituting a mut. nov. *semiaureus*, have the exuviæ bright orange.)

JAMAICA, WEST INDES (I.).

**Ceroplastes ceriferus* (Anders). Mr. W. Harris sends me specimens from Jamaica on burweed, *Triumfetta rhomboidea* Jacq. (n. g. p.). They were found at Cinchona on March 15, 1895. These scales differ a little from typical *ceriferus*, being very white, yet I cannot separate them specifically. The derm has very large oval gland pores, and is obscurely tessellated. The digitules of the claw are very stout, with large knobs; those of the tarsus long, moderately slender, with large knobs. (The only West Indian locality before known for the species is Antigua.)

**Icerya montserratensis* Riley & Howd. There were in the Jamaica museum some fragments of a coccid marked "19 Feb., 1886. No. 740. J. Hart." I brought away a portion of this material when I left Jamaica, as it was evidently something I had never found in the island; and on recently subjecting it to careful examination, I find it to be *I. montserratensis.* It differs from the type of that species in no important respect, though the club of the antennæ is not as long as the three preceding joints together. The antennæ are very large, 11-jointed. The ovisac is long, yellowish-white, strongly grooved. Mr. Hart, now of Trinidad, formerly lived in Jamaica, and presumably found these specimens there. It is curious that I never met with the species, if it has been introduced into the island.

NEW YORK STATE (N.).

Aspidiotus ancylus Putnam (cp. Comstock, 2d Cornell Rep., p. 59). Dr. Lintner sent me some of this from Albany, found several years ago on black currant (n. p.) in his garden.

Lecanium ribis Fitch. Dr. Lintner sent me specimens found in June, 1885 by Hon. G. W. Clinton, in Albany Rural Cemetery, on *Ostrya* (n. g. p.) and *Carpinus* (n. g. p.). Comparison

of these with examples from *Ribes* showed no valid distinction. This species may be readily known by its small size (long. 3, lat. 2, alt. 2¼ mm., looking a little like *L. hemisphæricum*), red-brown color; derm with large gland-pits, frequently in pairs; antennæ 6-jointed, 3 as long or longer than 4+5+6. The digitules of the claw are remarkably stout, but very little expanded at their ends.

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General Notes.

MINERALOGY.[1]

New Edition of Groth's Physical Crystallography.—The concluding part of the third edition of this classic work[2] has recently appeared, the entire book having been so largely rewritten as to be essentially new. The necessity of this shows what remarkable advances have been made in the science during the past few years. The new work is divided into three parts, treating respectively physical, geometrical, and applied crystallography. Unlike earlier editions, the development of the optics of crystals is not made to depend on Fresnel's theory of the elasticityof the ether, but the optical characters are derived by the purely geometrical methods of Fletcher. Some features of this treatment have been already referred to in these notes. This treatment of the subject, which is certainly the more logical and may prove to be easier of comprehension by the student, involves a considerable change in the nomenclature of optical directions.

The sections treating the electrical properties of crystals and the influence of mechanical forces on crystals, as would be expected, contain a vast amount of new material. In the closing section of this part,

[1]Edited by Dr. Wm. H. Hobbs, University of Wisconsin, Madison, Wis.

[2] Physikalische Krystallographie und Einleitung in die krystallographische Kenntniss der wichtigeren Substanzen von P. Groth. 3d Ed. pp. 783, 3 colored plates. Engelmann, Leipzig, 1894.

Bravais's space lattice theory of molecular structure is treated comprehensively, with addition of some of the modifications which have been made to it by Sohñche, Federow and Schönflies. Professor Groth states in his preface, that "the edifice of crystal knowledge is one of the best founded in theory of any in the entire realm of physics."

The second part of the work, that treating the geometrical properties of crystals, bears but slight resemblance to the corresponding portion of the former editions. Instead of the primary classification of Naumann into six crystal systems with their partial forms, which is in general use, the differentiation of Gadolin into thirty-two classes of forms which represent all possible kinds of crystal symmetry, is adopted. This classification does away with hemihedral, hemimorphic and tetartohedral divisions, which cause so much difficulty in teaching, and is logically and scientifically superior to the classification in use. Professor Groth thinks that the simplification of the nomenclature which this classification makes possible, will make the subject easier for the student, but it seems to us that the additional conceptions of symmetry (centre of symmetry, and 1, 2, 3, 4 and 6 *zählige* axes of symmetry) which are used will more than outweigh these advantages in simplicity, except for students who have what the Germans call *raümliche Vorstellungsgabe* highly developed. Of the thirty-two classes of forms, three have now no known representative, but when it is remembered that since 1887 representatives have been discovered for six classes which before lacked examples, the probability is great that examples will soon be found of all classes. The crystal systems are retained as a sub-classification to indicate relationships, and a seventh system—the *trigonal system*—is added to include those classes which have a 3-*zählige* axis of symmetry (rhombohedral, pyramidal, trapezohedral, etc., making in all seven classes). The word cubic is adopted for the isometric system. Another important change lies in the arrangement. The class of least symmetry is considered first, and the others in the order of increasing symmetry.

The subject of the calculation and drawing of crystals, which in the former editions of the work was scattered under the different systems in the geometrical portion, is here brought together and expanded to over 60 pages in the beginning of part III. It is followed by a description of the methods of crystal measurement, in which is contained what will be to many, new descriptions of recently devised apparatus. Such is a modification by Klein and Fuess of the Federow universal attachment to the microscope stage.

The appearance of this edition of Professor Groth's work marks an epoch in the history of crystallography, and there can hardly be a doubt that all the essential features of his treatment will soon be introduced at least in all advanced courses in the science. Crystallographers will look forward with anticipation to the appearance of the great work on chemical crystallography on which Professor Groth is now engaged.

Tables of the Thirty-two Classes of Crystal Forms.—In 1892 Groth[3] issued a table giving the stereographic projection to indicate the most general form of each of Gadolin's classes of crystal forms, together with the position of the crystallographic axes and the axes and planes of symmetry of the class. These differ from those of his later published text-book only in that the trigonal crystal system is not introduced in the secondary classification. This table has the great advantage of bringing all the projections together on a single plate so that mutual relations may be made out. Wülfing[4] has very recently issued a series of seven plates with explanatory text which give not alone the stereographic projections to illustrate the kind of symmetry of each class, but also sketches to indicate the character of all the kinds of crystal forms which can possibly occur with that kind of symmetry. They constitute an introduction to or a synopsis of the subject of geometrical crystallography, much as it is treated by Groth, and will be of service in making the subject clear to a beginner, particularly one who cannot easily bring his mind to the condition of picturing geometrical forms. Wülfing has, however, unfortunately adhered to the old arrangement, and treats the classes of highest symmetry first; and, moreover, has not utilized the abbreviated nomenclature adopted by Groth. This and the different numeration of the classes which the old arrangement involves, will introduce confusion, and are the serious mistakes of the little book. In his preface Wülfing recalls an interesting passage in Goethe, which brings out so well the difference between the position now held by the science of crystallography and that which it occupied at the time the words were written (they were first printed in 1829) that I am inclined to introduce it here. Goethe wrote referring to the science of crystallography as follows:

[3] Uebersichtstabelle der 32 Abtheilungen der Krystallformen mit Erlaüterungen, Beispielen, und graphischer Darstellung nach Gadolin zusammengestellt von P. Groth. Engelmann, Leipzig, 1892, 1 Mark.

[4] Tabellarische Uebersicht der einfachen Formen der 32 krystallographischen Symmetriegruppen zusammengestellt und gezeichnet von Dr. E. A. Wülfing. Koch, Stuttgart, 1895.

"Sie ist nicht productiv, sie ist nur sie selbst und hat keine Folgen...... ....Da sie eigentlich nirgends añwendbar ist, so hat sie sich in dem hohen grade in sich selbst ausgebildet. Sie giebt dem Geist eine gewisse beschräñkte Befriedigung und ist in ihren Einzelheiten so mannigfaltig, dass man sie unerschöpflich neñnen kañ, deswegen sie auch vorzügliche Meñschen so eñtschieden und lañge au sich festhält.—Etwas Mönchisch-Hagestolzenartiges hat die Krystallographie und ist daher sich selbst genug. Von praktischer Lebeñseinwirkung ist sie nicht; deñ die köstlichsten Erzeugñisse ihres Gebiets, die krystallinischen Edelsteine, müssen erst zugeschliffen werden, ehe wir unsere Frauen damit schmücken können."

Wülfing remarks "Can it not be doubtful if the sentence of Goethe's' 'crystallography has something of the bachelor monk about it and is hence sufficient unto itself; does not belong to a standpoint of the science already far behind us."

Wm. H. Hobbs.

PETROGRAPHY.[1]

An Example of Rock Differentiation.—The Highwood Mountains of Montana have afforded Weed and Pirrson[2] an interesting study in rock differentiation. The mountains comprise a group of hills composed of cores of massive granular rocks surrounded by acid and basic lava flows and beds of tuff, which are cut by hundreds of dykes radiating from the cores as centers. One of these hills, isolated from the others is known as Square Butte, whose laccolitic origin can be plainly shown. The Butte is composed entirely of igneous rocks. Its center is a core of white syenite, and around this as a concentric envelope is a dark basic rock called by the authors shonkinite. Near the top of the Butte the surrounding envelope has been eroded off exposing the white rock, so that from a distance the latter appears to be capping the former. The black rock consists of biotite in large plates and augite crystals, in the irregular spaces between which are found orthoclase, olivine, a little albite and small quantities of nepheline, cancrinte and the usual accessory minerals. An analysis of the rock gave:

[1] Edited by Dr. W. S. Bayley, Colby University, Waterville, Maine.

[2] Bull. Geol. Soc. Amer., Vol. 6, p 389.

SiO_2	TiO_2	Al_2O_3	Fe_2O_3	FeO	MnO	MgO	CaO	Na_2O	K_2O	H_2O	P_2O_5	Cl	Total
46.73	.78	10.05	3.53	8.20	.28	9.68	13.22	1.81	3.76	1.24	1.51	.18	=100.97

The rock is thus a granular plutonic rock consisting essentially of augite and orthoclase. It is closely related to augite-syenite, bearing the same relation to it as vogesite does to hornblende-syenite.

The white rock associated with the shonkinite is a sodalite-syenite, containing as its bisilicate component only amphibole. Its composition is given as follows:

SiO_2	TiO_2	Al_2O_3	Fe_2O_3	FeO	MnO	MgO	CaO	Na_2O	K_2O	H_2O	P_2O_5	Cl	Total
56.45	.29	20.08	1.31	4.39	.09	.63	2.14	5.61	7.13	1.77	.13	.43	=100.45

The basic rock is richer in iron, magnesia and lime than the acid one; since the two rocks pass into each other by a rapid but continuous gradation, they are believed to be of the same age and to be the complementary differentiated portions of the same magma. The differentiation in this case could not have been due to a process of crystallization, in which the first crystallized minerals were accumulated in the peripheral portions of the cooling magma, since the other iron-bearing components of the shonkinite and of the syenite are so radically different. The differentiation must have occurred in the magma while still molten.

The Serpentines of the Central Alps.—Three years ago Weinschenck[3] gave a preliminary account of the serpentines of the East Central Alps and their contact effects, showing that the former were originally pyroxene eruptives. In a recent paper he returns to the subject,[4] and in a well illustrated article gives in detail the reasons for his former conclusions. He finds upon the examination of a large suite of specimens that the original rock was an olivine-antigorite aggregate, which he names stubachite, from its most important locality. The antigorite is believed to be an original component and not an alteration product of the olivine, as it is found intergrown with perfectly fresh grains of the latter mineral. The grate structure ("Gitterstructur") of many serpentines is ascribed to such intergrowths, and not to the alteration of pyroxene along its cleavage planes. The original stubachite was a medium grained holocrystalline, allotriomorphic rock of intrusive igneous origin, which has not suffered much alteration since its exposure by erosion.

[3] American Naturalist, 1892, p. 767.

[4] Abhand. d. k. bayer. Ak. d. Wis II, Cl. XVIII, Bd. p. 653.

Becke[5] calls attention to the frequency with which a pyroxenic origin has been ascribed to serpentines of the Alps because of the lack in them of the mesh structure, and questions the safety of this conclusion when based on such scanty premises. He mentions the existence of a serpentine in the stubachthal in the Central Alps, in the freshest portions of which olivine and picotite can be seen in large quantities, and in other portions diopside and olivine. In many specimens the olivine has been crushed into a mosaic, the finer grains of which have been altered into serpentine, clinochlor, antigorite and what is probably colorless pyroxene. The mesh structure is found in the weathered portion of the antigorite-serpentine. It is thought by the author to be due to weathering subsequent to the production of the antigorite.

The central mass of the east central Alps consists of granite and gneiss,[6] of which the former is intrusive in the latter, although both have essentially the same mineralogical composition, and the former is schistose on its periphery. The granite contains zoisite, epidote, orthite, chlorite, calcite, etc., all of which are regarded as original, since the other primary components of the rock from which they may be assumed to have come are perfectly fresh. The origin of these minerals is ascribed to the cooling of the magma under the influence of mountain-making processes—a condition of crystallization which the author designates as piezocrystallization. The hydrated components of the rock are supposed to have been formed with the aid of magma moisture under the influence of pressure. This theory is believed to account for the granulation and other pressure phenomena noted in the granite, as well as for its composition.

Dynamic Metamorphism.—In connection with his work on the rocks of the Verrucano in the Alps, Milch[7] makes a study of dynamic metamorphism and suggests a number of terms to be used in the descriptions of metamorphic rocks. Allothimorphic fragments are those with the composition and forms of the original grains. Authimorphic fragments have the forms of the grains changed but their composition unchanged. Allothimorphic pseudomorphs have the original forms but a composition different from that of the original grains, and authimorphic pseudomorphs have both forms and composition changed, but with the latter dependent upon the original composition. Finally eleutheromorphic new products are those entirely independent of the

[5] Minn. u. Petrog. Mitth., XIV, 1894, p. 271.

[6] Ib., p. 717.

[7] Neues Jahrb. f. Min., etc., IX, p. 101.

original substances both in form and composition. Of the authimorphic fragments two classes are noted, first, the authiclastic, those that have been unable to adapt themselves to the altered conditions and, consequently, which have been fractured, and, second, the kamptomorphic, embracing those fragments that have been able to adapt themselves to changed conditions, and so have yielded to these and have bent, or have assumed abnormal optical properties, such as undulous extinctions. With these terms the author describes some of the rocks studied and states that in many instances no traces of clastic structure remain in them, although they must be regarded as regionally metamorphosed fragmentals. Regional metamorphism, he declares, may be brought about by pressure alone, or by dislocation—pressure with movement (dynamic metamorphism). The former may act slowly, deforming the minerals in rocks, while the latter acts rapidly, shattering them. The latter process usually forms rocks like the mica-schists, with a fine grain, and the former coarse grained ones like the gneisses. Of course, the action of water, which is the agent of transportation of the new substances added during metamorphism, may come into play in each case. The Verrucano rocks exhibit the effects of both kinds of regional metamorphism. The article contains a great many suggestions of interest to students of metamorphism.

Miscellaneous.—The conglomerates and albite schists of Hoosac Mountain, Mass., referred[8] to some time ago in these notes, have been described by Wolff[9] in some detail in his report on the geology of Hoosac Mountain. The conglomerates form gneisses which grade upward into the albite schists. Amphibolites also are described, whose origin is from a basic intrusive rock. A large number of photographs of hand specimens and thin sections of the rocks described accompany the paper.

Van Hise[10] in the report by Irving and himself on the Penokee iron district, gives a number of descriptions of sedimentary and volcanic rocks, illustrated by a large number of plates of thin sections. The rocks discussed include greenstone conglomerates, crystalline schists, intrusive greenstones, slates, quartzites, limestones, etc.

Ries[11] finds that one of the crystalline schists of the series of foliated rocks forming the greater portion of Westchester Co., N. Y., is a

[8] American Naturalist, 1892, p. 768.

[9] Min. XXIII, U. S. Geol. Survey, p. 41.

[10] Mon. XIX, U. S. Geol. Survey.

[11] Trans. N. Y. Acad. Sci., Vol. XIV, p. 80.

plagioclase-augen-gneiss which the author calls a schistose granite-diorite. Its constituents are quartz, plagioclase, biotite, hornblende and orthoclase as its principal components, with garnet, sphene, zircon, apatite, muscovite and microcline as the accessories. The quartz is penetrated by rutile needles. Nearly all the rock's constituents show evidence of dynamic fracturing.

GEOLOGY AND PALEONTOLOGY.

Dawson on the Oscillations of the Behring Sea Region.—Among the recent contributions to a knowledge of the coasts of Behring Sea are the notes made by G. M. Dawson during an extended cruise in that region. His paper is supplementary to that of Dall's relating to the American shores and islands of Behring Seas, and gives, generally speaking, the general physographic features of the land to which the attention of the earlier writer was not directed. We quote the following extracts from his general remarks.

"Behring Sea is a dependency of the North Pacific, marked off from it by a bordering chain of islands like those which outline Okhotsk Sea and the sea of Japan. It differs from these two seas by reason of its connection to the north with the Arctic Ocean, and in the fact that while the whole eastern part of its extent is comparatively shallow, the profounder depths of the north Pacific (in continuation of the Tuscarora deep) are continued into its western part. The Aleutian Islands, regarded as a line of demarkation between the main ocean and Behring Sea, are analagous to the Kurile islands with Kamtschatka, and to the islands of Japan. As to the Commander Islands, though these appear to lie in the continuation of the arc formed by the Aleutians, they are separated by a wide and, so far as known, very deep stretch of ocean from the last of these islands, and it is wholly probable that they may represent an altogether independent local elevation analogous to that to which Saint Matthew and its adjacent islands are due.

"The western part of Behring Sea has as yet been very imperfectly explored with the deep-sea lead, but the following general facts may be gathered from the existing charts: The entire chain of the Aleutian Islands is bordered at no great distance to the south by abyssal depths of the Pacific. The whole western portion of the chain likewise

slopes rapidly down on the northern side into very deep water, exceeding 1,000 fathoms as far to the eastward as Unimak Island; but from the vicinity of Unimak pass (longitude 165° west) the depths to the north of the islands are consistantly less than 100 fathoms. Beginning near the Unimak pass, the edge of the hundred-fathom bank runs northwestward, passing to the west of the Pribilovs and Saint Matthew Island and meeting the Asiatic coast in the vicinity of Cape Navarin, in about north latitude 60°. Thus all parts of Behring Sea to the north and east of this line, together with Behring Straits and much of the Arctic Ocean beyond, must be considered physiographically as belonging to the continental plateau region and as distinct from that of the ocean basin proper, and there is every reason to suppose that it has in later geologic times more than once and perhaps during prolonged periods existed as a wide terrestrial plain connecting North America with Asia.

"In all probability this portion of the continental plateau is a feature much more ancient than the mountain range of which the outstanding parts now form the Aleutian Islands. This range, though to some extent due to uplift, as for instance in the case of Attu Island, is chiefly built up of volcanic material. Its eastern part, in the Alaskan peninsula and as far as the Unimak pass, must be regarded as having been built upon the edge of the old continental plateau. Its western part, though certainly the continuation of the same line of volcanism, runs off the edge of the plateau and rises distinctly from the ocean-bed.

"The available evidence goes to show that the submarine plateau of the eastern part of Behring Sea, together with much of the flat land of western Alaska, was covered by a shallow sea during at least the later part of the Miocene period, while the most recent period at which this plateau stood out as land is probably that at which, according to facts previously noted, the Mammoth reached the Pribilof Islands and Unalaska Island across it.

"Evidence has recently been obtained of an important factor in regard to late changes of climate in this region, in the observations of Mr. I. C. Russel, which show that the great mountain range of the Saint Elias Alps must have been entirely formed in Pliocene or post-Pliocene times. The crumpling and upheaval of the beds which now form this range must have relieved a notable and accumulating tangential pressure of the earth's crust, the result of which it is yet difficult to trace; but that it must have brought about extensive changes of level throughout the region over which this pressure was exerted seems certain, and I

am inclined to suppose that it may have had much to do with the great later Pliocene uplift and subsequent depression to which the British Columbian region appears to have been subjected.

"One of the most remarkable features connected with the Behring Sea region is the entire absence of any traces of general glaciation. Statements to the effect that Alaska, as a whole, showed no such traces were early made by Dall and concurred in by Whitney. The result of my later investigations in British Columbia and along the adjacent coasts have been to show that such original statements were altogether too wide; that a great Cordilleran glacier did exist in the western part of the continent, but that it formed no part of any hypothetical polar ice-cap, and that large portions of northwest America lay beyond its borders.

"Statements made by Mr. John Muir, in which he not only attributed every physical feature noted by him in Behring Sea to the action of glaciation, but even expressed the opinion that Behring Sea and Strait represented a hollow produced by glaciation, remained altogether unsupported. It might be unnecessary even to refer to them but for the fact that they relate to a region for which data on this subject from other sources are so small. No traces have been found of general glaciation by land-ice in the region surrounding Behring Sea, while the absence of erratics above the actual sea-line show that it was never submerged for any length of time below ice-encumbered waters.

"The facts, moreover, connect themselves with similar ones relating to the northern parts of Siberia in a manner which will be at once obvious to any student of the glacial period." (Bull. Geol. Soc. Am. Vol. 5, 1894.)

Green Pond Conglomerate.—In Darton's paper on the outlying series of Paleozoic rocks which occupy a narrow belt extending from the Archean highlands of New Jersey into Orange Co., New York occurs the following description of the Green Pond Conglomerate.

"The greatest development of this formation is in New Jersey, where it is continuous over a wide area, and gives rise to a number of prominent ridges. In New York there are three small outlying areas: Pine Hill, northeast of Monroe, and two small ridges west of Cornwall station. Throughout its course it consists of coarse, red conglomerates below, and buff and reddish quartzites above, and the characteristics of these members are uniform throughout. The conglomerates consist of quartz pebbles from one-half to two inches in diameter in greater part, in a hard, sandy, quartzitic matrix of dull red color. The proportion

of pebbles to matrix is usually large, but there is local variation in this regard. The pebbles are mainly well rounded, but some subangular ones occur. They are mostly all of quartz, and white or pinkish in color. No quartzite pebbles were observed. In this characteristic the Green Pond Conglomerate differs greatly from the Skunnemunk conglomerate, but otherwise they are very similar. The thickness of the Green Pond conglomerate varies. In New York there are not over 60 feet, but in New Jersey it will probably be found to average about 150 feet in its greatest development in Green Pond and Copperas Mountains. Owing to its extreme hardness and massiveness, it give rise to high, rocky ridges with precipitous slopes in greater part. Green Pond, Copperas, Kanouse and Bowling Green Mountains are the most prominent of these, and they occupy an area of considerable size in New Jersey. South of the south end of Green Pond Mountain west of Dover there are outliers of conglomerates and sandstones probably of this age, which are described by book in the 'Geology of New Jersey' 1868.

"In the vicinity of Cornwall Station the conglomerate lies on Hudson shales; Pine Hill, on Cambrian limestone, at least in part; in Kanouse Mountain, on slates possibly of Hudson age, northward, and on Cambrian limestone southward; in Green Pond, Copperas and Bowling Green Mountains it lies directly on the crystalline rocks. The contact with the crystalline rocks is exposed along the upper part of the eastern slopes of Copperas Mountain, and the surface is a relatively level one. Small enclosed areas of the crystallines are bared by erosion of the conglomerate along the two anticlinals south of Newfoundland, and I find that gneiss extends to within half a mile of the depot in the western flexure. Along the axis of the eastern flexure, gneiss extends to and under Green Pond and down the gorge of the outlet of the pond to the end of Copperas Mountain. Along these anticlinals no actual contacts were found, but from many exposures in its vicinity the relative eveness of the floor was clearly apparent. In the Bowling Green Mountain the conglomerate is wrapped around the northern end of a ridge of gneiss, but its contact relations were not observed.

"The age of the Green Pond conglomerate and quartzite is approximately the same as Shawangunk grit and Oneida conglomerate, and probably they also represent all or a portion of the Medina. They are, at any rate, the representatives of the great arenaceous sedimentation at the beginning of the Upper Silurian. The evidence of their position is mainly their intimate relation to the Helderberg limestone throughout and the fact that they overlie the Hudson shales in New York and

probably also in New Jersey. Throughout their course in New Jersey and in New York the upper quartzites grade into the Longwood red shales, and these into the Helderberg limestone, constituting a series which overlaps the Archean, the Cambrian limestone and the Hudson shales. This stratigraphic relation, as well as precise lithologic similarity, served to correlate the Pine Hill and Cornwall Station areas with those of the Green Pond region in New Jersey. The superposition on the Hudson shale is unquestionable in the Cornwall region, where the Green Pond, Longwood, Helderberg and other series present the full sequence. In New Jersey there are shales underlying the conglomerate along the east side of Kanouse Mountain near its northern end, but it is not as yet demonstrated that they are Hudson in age.

"The estimate of the total thickness by Merrill of 600 feet in the Newfoundland region is considerably too great. I find that the 500 foot cliff south of the station, on which his estimate is based, contains nearly 100 feet of crystalline rocks at its base, but probably a considerable portion of the original thickness of sandstone was removed from its summit. The formation appears to attain its greatest thickness at this locality, for the average amount is considerably less elsewhere.

"The name Green Pond Mountain conglomerate or series has been applied to the formation by Cook, Smock and others, and, although originally always used to include the Skunnemunk conglomerate, it is, I believe, an appropriate name, with proper restriction, for the Upper Silurian member. The "mountain" may be omitted to advantage, as Green Pond is a typical locality. It is not proposed at present to separate the quartzite under a distinctive name." (Bull. Geol. Soc. Am., Vol. 5, 1894.)

Notes on the Osteology of Zeuglodon cetoides.—Last November Mr. Charles Schuchert of the U. S. National Museum obtained for that institution portions of the skeletons of two Zeuglodons. These have since been "developed" and the bones thus brought to light promise to add some points of interest to our knowledge of this interesting form.

The lower jaw, like that figured by Müller, contained six molariform teeth, showing that the number of premolars plus molars should be given as five to six, and not limited to five, as in Nicholson and Lydekker's Manual of Palæontology. The jugals, although slender, are much heavier than in the toothed whales, and the hyoid was apparently like that of a Sirenian, the basihyal being rather broad and flattened, the ceratohyal, long, curved, expanded at its distal end, and

articulating directly with the basihyal and not through the interposition of a long cartilage. The first four cervicals are very curiously interlocked; the atlas gives off a process from its ventral surface which curves back to almost touch the axis; the spinous process of the axis overlies the atlas in front, and extends backwards until it nearly touches the spinous process of the fourth cervical, that of the third cervical being abortive. The fourth cervical sends down a long parapophysis. The dorsal vertebræ are apparently fourteen in number, and none appear to have been lost. The last three ribs have no tubercle and unite with the middle of the centrum by a large head; the 10th and 11th ribs have a small tubercle although articulating with the body of the vertebra; the fifth rib is remarkable for its great upward curvature; the second to seventh ribs are much swollen towards the distal extremities.

The scapula is thoroughly cetacean in shape, as well as in the length of the acromial and coracoidal processes. The humerus is, as figured by Müller, heavy at its proximal end and tapering rapidly towards the distal extremity; the radius and ulna are so articulated with one another and with the humerus, as to permit flexion and extension only; the olecranal process is large, wide and flat; the distal ends of radius and ulna are rough and their epiphyses may have been entirely cartilaginous; two or three small bones of irregular form are very likely carpals, and if so they too were largely cartilaginous. No traces of hind limbs have as yet come to light.

The regular articular posterior extremity of the first sternal segment has led Professor Cope to suggest that the animal was in the habit of rearing the front part of its body out of water, and this suggestion derives additional weight from the shape of the articular faces of the dorsals; they indicate that not only was there movement in the dorsal region from side to side, but up and down, and show that the intervertebral cartilages were very thick. Many of the lumbo-caudals have the faces slightly approximated dorsally, indicating considerable vertical movement in this region. The change from the short centra of the dorsals to the extremely elongate centra of the lumbo-caudals is very abrupt and the vertebral column doubtless terminated with equal abruptness, since vertebræ a long way from the head are very massive. A curious feature is the prominence of the anterior zygapophyses in the lumbo-caudal region, since the spinous process are from 8 to 12 inches apart. Above all one is struck with the small size of the head and thorax when compared with the posterior region of the body, and it would seem that the head must have had a busy time in order to capture sufficient food to sustain the huge tail.—F. A. Lucas.

BOTANY.[1]

Decades of North American Lichens.—Botanists have lately received the 16th, 17th and 18th decades of this interesting distribution by Clara E. Cummings, T. A Williams and A. B. Seymour. An examination of the specimens shows them to be most satisfactory. The species included are the following: 151. *Ramalina lævigata* Fr. (Tex.); 152. *R. pollinarella* Nyl. (So. Dak.); 153. *Evernia vulpina* (L.) Ach. (Calif.); 154. *Theloschistes villosa* (Ach.) Wainio, (L. Calif.); 155. *Parmelia borreri* Turn. (So. Dak.); 156. *Umbilicaria hyperborea* Hoffm. (N. H.); 157. *U. phæa* Tuck. (Calif.); 158. *Sticta aurata* (Sm.) Ach. (So. Car.); 159. *S. anthraspis* Ach. (Calif.); 160. *Peltigera aphthosa* (L.) Hoffm. (Me.); 161. *Pannaria lanuginosa* (Ach.) Koerb. (Iowa); 162. *Collema pulposum* (Bernh.) Nyl. (Iowa); 163. *Leptogium pulchellum* (Ach.) Nyl. (Iowa); 164. *Placodium murorum* (Hoffm.) DC., (Mass.); 165a. *P. cerinum* (Hedw.) Naeg. & Hepp. (Ohio); 165b. *P. cerinum* (Hedw.) Naeg. & Hepp. (Iowa); 166. *Lecanora muralis* (Schreb) Schaer., a. *saxicola* Schaer. (Iowa); 167. *Lecanora varia* (Ehrh.) Nyl. d. *symmicta* Ach. (Me.); 168. *Rinodina oreina* (Ach.) Mass. (So. Dak.); 169. *R. sophodes* (Ach.) Nyl., e. *exigua* Fr. (So. Dak.); 170. *Pertusaria velata* (Turn.) Nyl. (Iowa); 171. *Biatora suffusa* Fr. (Iowa); 172. *Buellia oidalea* Tuck. (Calif.); 173. *Opegrapha varia* (Pers.) Fr. (So. Dak.); 174. *Graphis afzelii* Ach. (La.); 175. *G. scripta* (L.) Ach., var. *serpentaria* Ach. (So. Dak.); 176. *Arthonia dispersa* (Schrad.) Nyl. (Nebr.); 177a. *A. lecideella* Nyl. (Mass.); 177b. *A. lecideella* Nyl. (Iowa); 178. *A. radiata* (Pers.) Th. Fr. (Iowa); 179. *Calicium quercinum* Pers. (Ohio); 180. *Pyrenula subprostans* (Nyl.) Tuck. (No. Car.).

CHARLES E. BESSEY.

North American species of Polygonum.—Mr. John K. Small has done a good work in bringing out his monograph of this interesting genus, which is issued as one of the Memoirs from the Department of Botany of Columbia College. All told there are according to this paper, seventy species, and in discussing these, the synonymy is fully and carefully worked out. The descriptions are full, and leave little to be desired. The omission of all reference to type specimens, and specimens examined from different localities and herbaria is to be

[1] Edited by Prof. C. E. Bessey, University of Nebraska, Lincoln, Nebraska.

regretted, especially as this might have been done very easily. This monograph will be of much service to students of these widely distributed plants.

Notes.—Two valuable papers on embryology have recently appeared in the *Botanical Gazette,* viz. "The embryo-sac of *Aster novæ-angliæ*" by Charles J. Chamberlain and "Contributions to the embryology of the Ranunculaceæ," by David M. Mottier. Part III of Murray's "Phycological Memoirs" appeared in April (London, Dulau & Co.). It contains papers on *Pachytheca,* calcareous pebbles formed by Algæ, Diatoms (list), *Macrocystis* and *Postelsia,* and a Comparison of the Arctic and Antarctic Marine Floras. Baillon's Histoire des Plantes has nearly completed its thirteenth volume, the last part being a monograph of the Palmaceæ. The illustrations are, as usual, of high excellence, and the general treatment is quite like that in preceding parts. Botanists will not be likely, however, to accept his substitution of *Rotang* L., Fl. Zeyl. (1747) for *Calamus* L., Sp. Pl. (1753). We notice, also, that the author doubts the validity of Sereno Watson's genus *Erythea,* suggesting its identity with either *Brahea* or *Copernica.* From a notice of the London Catalogue of British Plants, in the June number of the *Journal of Botany,* we learn with pleasure that our usually conservative brethren across the water have adopted some of the "radical" views of certain American botanists. The editor of the the *Journal* says "certain necessary alterations in nomenclature have been made" and then gives without a word of dissent the following:

Nuphar Sm., now *Nymphæa* L.

Nymphæa L., now *Castalia* Salisb.

Corydalis Ventenat, Choix des Plantes, xix (1803), now *Neckera* Scopoli, Introd. 313 (1777).

Capsella Medic. Pflanzeng. i. 85 (1792), now *Bursa* Weber, in Wigg. Prim. Fl. Holsat. 47 (1780).

Lepigonum Wahlberg, Fl. Gothob. 45 (1820), now *Buda* Adanson, Fam. des Plantes, ii. 507 (1763).

Mertensia Roth, Catalect. i. 34 (1797), now *Pneumaria* Hill, Veg. Syst. vii. 40 (1764).

Calystegia Brown, Prodr. 483 (1810), now *Volvulus* Medic, in Staatsw. Vorles. Churpf. Phys. Oek. Ges. i. 202 (1791).

Leersia Solander, ex Swartz, Prod. Ind. Occ. 21 (1788), *Homalocenchrus* Mieg, ex Haller, Stirp. Helv. ii. 201 (1768).

VEGETABLE PHYSIOLOGY.[1]

Woronin on Sclerotinia.—Dr. Woronin who was formerly associated with De Bary and whose beautiful studies of the life history of the smut fungus, *Tuburcinia trientalis* at once placed him among the very foremost investigators in a difficult field, continues to unravel interesting life histories of the pleomorphic fungi. Some years ago he published valuable researches on the Sclerotinia diseases of Vaccinium berries, and now distributes an important paper on the Sclerotinia disease of the bird cherry and of mountain ash. This paper (Die Sclerotinienkrankheit der gemeinen Traubenkirsche und der Eberesche, *Sclerotinia padi* und *Sclerotinia aucupariae*) is a quarto of 27 pages illustrated by five superb lithographic plates. It is printed in *Mém. de l'Acad. imp. de St. Petersbourg*, VIII, sé., Class Physico-Mathematique, Vol. II, No. 1. *S. padi* attacks and kills young leaves, fruit and stems of *Prunus padus*, on which the grayish, pulverulent conidia soon appear. On the host plant these conidia cause a distinct almond-like odor similar to that of the flowers, but no such odor could be detected when the fungus was grown on artificial media. Growing on the mountain ash the conidia of *S. aucupariae* cause an odor resembling that of the flowers of that tree. The apothecia of *S. padi* appear in the spring on the fallen, mummified fruits. Paraphyses and asci are always borne by distinct hyphae, the ascogeneous hyphae being stronger and thicker. The ascospores have two envelopes, an outer delicate one which is cast off in water and subsequently becomes gelatinous to complete disappearance, and an inner, colorless, thick-walled true membrane. When germinated in pure water the ascospores soon begin to form chains of small round spermatia-like sporidia, and the conidia behave in the same way. Ascospores sown in nutrient media or on the host send out strong germ tubes, but conidia or ascospores taken from nutrient media and put into pure water stop the production of hyphae and begin to form the above mentioned sporidia. In nutrient media an abundant conidial fructification was developed from ascospores in 3–4 days, and this was exactly like that observed in nature. Direct experiment with ascospores showed that the leaves are infected as they emerge from the bud, the stems being browned and killed by a secondary infection, just as peach twigs are destroyed by Monilia fructigena, only in case of the

[1] This department is edited by Erwin F. Smith, Department of Agriculture, Washington, D. C.

peach the stem infection takes place apparently only through the blossoms or fruits, and here apparently only through the leaves. The striking similarity may be seen by comparing Woronin's Fig. 23, Table II, with *Journal of Mycology,* Vol. VII, Plate V, figs. 1, 2 and 3. The germ tubes bore directly through the epidermal cells of the host or penetrate at the junction of two or more cells. In no case were they found entering through stomata, although most of the infections were through the underside of the leaf. On culture media long chains of conidia develop before any septa appear. Finally the ripe conidia are separated by delicate spindle-form or diamond-shaped disjunctors consisting of two minute cones of cellulose joined at their bases and having their apices connected with the two adjacent spores. Neighboring ascospores and conidia as well as germ tubes often fuse, and this is very striking in case of the infection of the incipient fruit through the stigma. For this purpose a half dozen conidia may fuse into a sort of colony or association giving rise to a single, very robust hypha which grows down the style after the manner of a pollen tube and finally infects the ovary. Fusions of spores and of hyphae are common enough in fungi, but fusion for so manifest and important an end is certainly noteworthy. The elongated penetrating hypha usually remains unbranched until the ovary is reached. In 3–4 days from the time of placing the spores on the stigma the germ tube has reached and entered the micropyle, and a day or two later the nucellus is invaded. No further development of the fungus takes place unless the flower has been fertilized by a pollen tube. In that case there is a movement of nutrient substances into the ovary, and on these the fungus makes a luxuriant growth. First the nucellus is occupied, then the integuments are invaded, and finally the pericarp, following which the young fruit browns externally and shrivels, and, if the air is moist enough, conidia appear on its surface. During early stages of germination 4–10 problematic bodies resembling nuclei appeared pretty constantly in each germ tube and then disappeared. The fungus on mountain ash is smaller than *S. padi,* but is otherwise very similar. The paper closes with 5 pages on relationships among Sclerotinia.—ERWIN F. SMITH.

Demonstration of Photosyntax by Bacteria.—In *Verhandelingen d. Koninklijke Akad. van Wetenschappen te Amsterdam* (2 Sectie, Deel III, No. 11) Professor Th. W. Engelmann summarizes in a brief paper (Die Erscheinungsweise der Sauerstoffausscheidung chromophyllhaltiger Zellen im Licht bei Anwendung der Bacterienmethode) what is known on this subject, and illustrates it very satisfactorily by

a well executed chromolithographic table. The value of this method rests on the fact that aerobic motile bacteria cease to move as soon as oxygen is withdrawn, and again become motile when a trace of it is added. This method of showing the photosyntax of chlorophyll-bearing cells is very delicate and exceedingly simple. A round green algal spore is placed on a slide in the center of a drop of water containing some aerobic actively motile bacterium and imprisoned by an ordinary cover glass cemented to the slide air tight by vaseline. If this preparation is now examined immediately, the bacteria will be found uniformly distributed through the drop and actively motile. They pay no attention to the green spore because they find sufficient oxygen everywhere. If the slide is now placed in the dark the movement of the bacteria gradually ceases with the exhaustion of the oxygen, and in this condition also the bacteria pay no attention to the algal cell. If, however, such a slide be left exposed to the light, the bacteria begin in a minute or two to swarm around the green spore and continue to do so as long as it is exposed to the light. Under these conditions there is a zone close to the spore and about as wide as the diameter of the latter, crowded with actively motile bacteria, a much wider zone in which there are only a few organisms swimming about, and a remoter zone of uniformly distributed non-motile bacteria. If now the mirror of the microscope be shaded so as to let barely enough light through for seeing, all self motion ceases and the bacteria which have crowded into a narrrow zone around the green spore begin to be distributed through the liquid uniformly by molecular movements. When bright light is flashed in again, active movement begins immediately, centering around the spore, and the two zones are reproduced, but if only a moderate amount of light is let in, only a small amount of oxygen is given off, only a few bacteria become motile, and these crowd back the rest forming a narrow clear zone of motile organisms, bounded by a crowded quiet zone, bounded in turn by a clear quiet zone, outside of which the bacteria are evenly divided. If a little more light be let in the number of motile organisms around the green spore increases, the inner clear zone widens, and finally with full light we have immediately the first condition, viz., a dense swarming mass of organisms around the algal cell, next a wide zone having in it only occasional rods, all of which are motile, and farther away a uniform distribution of organisms, which are non-motile because they have not felt the influence of the oxygen given off by the green spore. The algal cell of course gets from the bacteria CO_2 in return for the oxygen. Beautiful results can be obtained with threads of Cladophora, Spirogyra and other algæ, and

Spirogyra with the hay bacillus may be used to show that it is not the colorless protoplasm, nucleus, cell sap, or cell wall, but only the chromophyll bodies that give off oxygen. Light thrown on a chlorophyll band of Spirogyra causes the bacteria to swarm to it, while light thrown on any other part of the cell causes no crowding or movement of the bacteria. Light thrown on a chlorophyll band, after being passed through an alcoholic solution of chlorophyll derived from Spirogyra, caused no crowding or movement of the bacteria, while light passed through red glass, although less intense, caused an active swarming of the bacteria around the illuminated part of the band. The same method may be used to show whether red and variously colored cells contain chlorophyll, and whether the chlorophyll-bearing protoplasm of a cell is living or dead. The author obtained some of his results with undetermined bacteria from the surface of slightly foul water, but fresh cultures of Bacillus subtilis also gave good results. Organisms which make only a small demand on free oxygen, such as Vibrio lineola and Spirillum tenue give somewhat different results. In this case the motile organisms crowd around the algal spore or thread only when it is under the influence of feeble light. When bright light is let in, too much oxygen is given off, and a space is cleared around the green cell which widens or narrows in proportion to the varying of the light. With waning vigor of the chlorophyll the same results are obtained in bright light as with vigorous cells in feeble light, i. e., a crowding of the bacteria close up to the algal cell. The appended bibliography includes 61 titles, beginning with the year 1881, when Engelmann first published on this subject.—ERWIN F. SMITH.

Detection of Glukase by Auxanographic Methods.—Beyerinck has devised a neat method for showing that the enzym, glukase, first changes cooked starch into dextrine and subsequently into glucose. Over ½ the bottom of a Petri dish or similar receptacle, which part we will designate A, he pours a nutrient gelatine (10 per cent. gelatine; ½ per cent. soluble starch; ¼ per cent. asparagin; $\frac{1}{20}$ per cent. potassium phosphate) infected with Saccharomyces ellipsoideus or any other maltose yeast which is able to take nitrogen from asparagin, but will not react on dextrine. Into the other ½ of the dish, which we will designate B, he pours a nutrient gelatine infected with the same yeast and of identical composition except that the soluble starch is left out. Of course, no growth occurs in either part, because neither contains any carbohydrate on which this yeast can feed. A small area on A is now strewn with glukase powder and at some distance the same powder is

strewn on a part of B. Wherever the glukase powder falls on A, dextrine is formed out of the soluble starch, and from this, under the influence of the same enzym, glucose is produced. The latter is food for the yeast and growth begins at once, but as glucose is not diffusible through the gelatine, and as dextrine is not food, the growth of the yeast is sharply limited to the spot covered by the enzym, which is but slightly diffusible and is itself not food for the yeast. On B there is at first no growth even where the glukase falls, but after a time some of the dextrine produced on A escapes from the enzym spot and, being diffusible, passes through the gelatine without influenceing the imprisoned yeast cells until the glukase spot on B is reached. Here the fresh enzym immediately converts the dextrine into glucose, as shown by the production of an S. ellipsoideus auxanogram, the yeast spot corresponding in shape not to the area strewn with the enzym, but to so much of it as has been entered by the diffusion curve of the dextrine. This method was employed to determine what seeds contain glukase and to locate it in particular parts. The yeast is much more sensitive to minute quantities of glukase than chemical tests or polarized light. Glukase occurs in ungerminated maize principally in the horny part of the endosperm. It also occurs in abundance in the endosperm of sorghum and millet seeds, and is present in the seeds of about a dozen families of monocotyledons, i. e., in those having a mealy endosperm. Most seeds which are free from endosperm, or in which the endosperm is fleshy or horny, do not contain it. It does not occur in ungerminated wheat, rye or barley. Fresh starch grains outside the plant are attacked by glukase just as little as by diastase. Inuline also remains unchanged. The product of the action of glukase on maltose is glucose pure and simple. Dextrine is less readily converted into glucose than is maltose, and soluble starch is still less readily converted. These notes are from the third part of a long paper, Ueber Nachweis und Verbreitung der Glukase, das Enzym der Maltose, in *Centrb. f. Bakt. u. Par., Allg.*, I, 6, 7-8, and 9-10.—Erwin F. Smith.

ZOOLOGY.

The Characters of the Enchytræid Genus Distichopus.— In the absence of any information regarding the internal structure of the *Distichopus silvestris* of Leidy, European students of the Oligo-

chæta have rightly treated this species cautiously, there being no data to indicate its position in the system. That Beddard, in his recent Monograph has seemed uncertain even of the Enchytræid nature of the form, has led me to make a brief statement of its anatomical characters.

Setæ, as stated by Leidy, are restricted to the ventral series of bundles. That these are truly the ventral bundles is shown by the position of the nepridial openings at the same level, and the relation of the bundles to the lateral line. There appears to be no glandular replacements of the dorsal setæ. The complete, typical seta bundle consists of two pairs, an outer of larger and an inner of smaller setæ, disposed symmetrically. Such bundles were rarely present in the material examined, and were confined to the ante-clitellar region. In some specimens they were entirely absent. Behind the clitellum, four, or even three, setæ were seldom found, two being the rule, and on a variable number of the posterior segments only one. Often some of the segments were without setæ. This irregularity in distribution, the frequent absence of setæ on a somite, and the fact that the posterior pairs were usually the outer or larger setæ, indicate a retardation in the successive production of new pairs of setæ, and a consequent tendency toward a reduction of the number in the bundle.

In form, the setæ are peculiar, being very stout, swollen in the middle, blunt-pointed and slightly curved externally and hooked internally.

A cephalic pore is present between the prostomium and peristomial ring; but no dorsal pores were observed, though this is not conclusive evidence of their absence.

The inter-segmental septa, from the second to the sixth inclusive, are very thick and muscular, and the last three of these, namely, iv-v, v-vi, and vi-vii, bear prominent septal glands on their anterior faces. The bundles of ductules from these glands open as usual on the surface of a prominent dorsal pharyngeal pad, which was the usual structure.

The testis papillæ are united into a transverse ridge of simple columnar cells. The alimentary canal presents no marked enlargements, constrictions or saccular outgrowths. Its musculature is unusually powerful, and the two sets of fibres cross in a trellis-like arrangement, which is complicated at the septa.

The pepto-nephridia (salivary glands) are a pair of branched tubular structures in somite v, and are similar to those of several species of Fridericia with which they have been compared.

The ante-septal portion of the nephridia is small, and consists mainly of the funnel; the post-septal is large, with a prominent dorsal lobe,

and a slender ventral portion, from which the terminal duct arises. The intra-cellular canal is very tortuous, and in part seems to form a plexus such as has been described for other Enchytræidæ by Bolsius. Nuclei are prominent, but cell divisions in the granular protoplasmic mass, not apparent. No spermatheca have been found.

The essential sexual organs occupy the usual positions. The funnel of the vas deferens is rather small, with an oblique, ventrally directed mouth. Its duct is slender, closely coiled entirely within the twelfth somite, and about five or six times the length of the funnel. It terminates in a copulatory apparatus exactly like that of the Fridericia examined, that is, the duct perforates the muscular sheath of the spherical prostate gland, which is composed of radiating pyramidal cells, and opens immediately dorsal to the mouth of the gland into a tabular invagination of the body wall (atrium), which can be everted to serve as a penis. The oviducts have the usual form and position.

Peritoneal corpuscles are of two kinds, the smaller ones being about half the diameter of the nuclei of the large ones, elliptical and refringent.

The supra-œsophageal ganglion is truncate or slightly concave posteriorly and varies in relative length.

The dorsal blood vessel arises from the sinus in somites xiii and xiv and hence is post-clitellian. There is an internal chain of valve cells, not, however, very greatly developed. The only other peculiarity of the vascular system is in the structure of the endothelium bounding the peri-enteric blood sinus, which requires further study.

The above is an abstract of a detailed account which was prepared with appropriate figures last winter, but which has been withheld in the hope that an acquisition of fresh material would permit the elucidation of several doubtful points.

The material on which this account was based consisted of several rather poorly preserved specimens found among the collections left by the late Dr. Joseph Leidy at the University of Pennsylvania.

The several points referred to above about which I am still in doubt are the character of the spermathecæ, if present, the presence or absence of dorsal pores, the minute structure of the nephridia, and the number of species, there being indications of the existence of two. Furthur studies of the variations and distribution of the setæ are also desirable.

Michaelsen, in his synopsis, has placed Distichopus next to Fridericia, but apparently without any intention of suggesting relationship. That such a relationship exists, and that Distichopus finds its closest

ally in Fridericia, is perfectly evident from the above account. The form of the setæ is easily derived from the straight, internally hooked type of Friedericia, while their arrangement in the bundles is even more characteristically of the Friderician plan. The post-clitellar origin of the dorsal vessel, the colorless blood, the two kinds peritoneal corpuscles, the large size and branched arrangement (as in some species of Fridericia) of the salivary glands, the simple alimentary canal, the character of the male ducts and of the nephridia are all characters which these two genera possess in common. On the other hand, Distichopus is clearly separated Fridericia by the abortion of the dorsal setæ bundles, and perhaps by the absence of dorsal pores.

The absence of dorsal setæ is not to be regarded as allying Distichopus with Anachaeta.—J. Percy Moore.

New Mollusca from the Pacific.—While the *Albatross* was engaged in making soundings between the coast of California and the Hawaiian Islands in 1891–92, some dredgings were made on the archibenthal plateau about the islands in water from 300 to 400 fathoms deep, from which a small collection of molluscs and brachiopods was made. This material is now reported upon by Mr. W. H. Dall. It proves to be most interesting, and wholly new, not a single species heretofore described, either from the deep sea or from the Hawaiian Archipelago, being found among the dredgings. A new subgenus of Pleurotomidæ, the hitherto unknown and very interesting soft parts of a species of Euciroa, regarded as belonging to the Verticordiidæ, but now necessarily raised to family rank, and several new Brachiopods, are described. To these are added a few new species from the northwest American coast.

The Hawaiian collection is distributed as follows: Gasteropoda 11, Scaphoda 2, Pelecypoda 4. The northwest American species have been described before, but are now figured with a few additional notes, and 13 new species added to the list. (Proceeds. U. S. Natl. Mus. xvii, 1895.)

Taylor on Box Tortoises.—In a classification of the Box Tortoises of the United States, Mr. W. E. Taylor adopts the species recognized by Baur, and adds one new one, *Terrapene baurii.* The author agrees also with Baur as to the important position in the taxonomy of Terrapene of the modification of the zygomatic arch, and gives seven figures, showing that the quadratojugal is well developed in primitive forms of the genus, rudimentary in intermediant forms, and absent in *T. ornata*, the most specialized species.

In regard to distribution, the author has compiled the following facts: *T. major* is a Gulf species, and ranges from the mouth of the Rio Grande to Florida, possibly including southern Georgia. *T. baurii* belongs to the peninsula of Florida, possibly including southern Georgia. *T. carolina* is found in northeastern United States, extending from the St. Lawrence and Great Lakes south to the Carolinas and Tennessee, and west to the Mississippi River in Kentucky and to eastern Illinois. Concerning *T. mexicana* the data are insufficient to outline its range. *T. triunguis* occupies the swampy districts of the Lower Mississippi and bordering territory. *T. ornata* belongs to the plains and tablelands east of the Rocky Mts. from the Rio Grande north to the Yellowstone River. (Proc. U. S. Natl. Mus. Vol. XVII, 1895).

Although these box tortoises are similar in external appearance, they cannot be referred to a single genus owing to the extraordinary differences in the characters of the zygomatic arch which Baur has shown to be present. They furnish an illustration of a case where the generic characters are more conspicuous than the specific. Using the table furnished by Mr. Taylor, we will have the following:

I. Three digits to the hind foot.

Zygomatic arch complete,	*Pariemys*, g. n.
Zygomatic arch incomplete,	*Onychotria* Gray.

II. Four digits to the hind foot.

Zygomatic arch complete,	*Toxapsis* g. n.
Zygomatic arch incomplete,	*Terrapene* Merr.

The only species of Pariemys is *P. baurii* Taylor. Of Onychotria there are two species, *O. triunguis* and *O. mexicana*. Of Toxaspis but one species is known, viz., *T. major;* while there are two of Terrapene, viz., *T. carolina* and *T. ornata*.—E. D. Cope.

The Genera of Xantusiidæ.—The interesting additions to this family of lizards made by Stejneger and Van Denburgh exhibit a large range of variation in scutellation of the head. It appears to me that neither of the species added by these gentlemen can be properly referred to Xantusia, and I would distinguish them as the types of two genera. The genera of Xantusiidæ appear to me to be five, distinguished as follows:

I. One frontal and frontonasal plates.

Superciliary scales, none; pupil round, *Lepidophyma* Dum.
Superciliary scales present; pupil erect, *Xantusia* Bd.

II. One frontal and two frontonasal plates, pupil erect.

An interoccipital plate; frontoparietals in contact; superciliaries, *Zablepsis* Cope.
No interoccipital; frontoparietals widely separated; superciliaries, *Cricosaura* Pet.

III. Two frontals and one frontonasal; pupil erect.

No interoccipital; frontoparietals in contact; superciliaries, *Amœbopsis* Cope.

Each genus includes but one species except Xantusia, which has two. The type of Zablepsis is the *Xantusia henshavii* Stejneger, and the type of Amœbopsis is *X. gilbertii* Van Denburgh. The former is from Southern, the latter from Lower California.—E. D. COPE.

Occurrence of the Siberian Lemning-Vole (Lagurus) in the United States.—In describing a new vole (*Arvicola pallidus*) from Dakota, in 1888,[1] I referred it to the subgenus *Chilotus* of Baird, with which it agrees in the number of triangles in the molar teeth. Two years later, when studying a collection of voles from Idaho, I found that *pallidus* and its near ally *pauperrimus*, differed from *Chilotus* in important cranial and external characters, and the teeth, while agreeing in the number of triangles, differed materially in other respects. They were, therefore, removed from *Chilotus*,[2] but a new subgenus was not erected for them because it was believed that they would be found to fit into some of the numerous named groups of Eurasian voles of which no specimens were then available for comparison. Through the courtesy of Mr. Gerrit S. Miller, Jr., I now have before me a skin and skull of the Siberian *Lagurus lagurus* (Pallas) [=*Eremiomys lagurus* Auct.[3]], collected at Gurjew on the north shore of the Caspian Sea, and recently received by him from

[1] AMERICAN NATURALIST, August, 1888, 702–705.

[2] N. Am. Fauna, No. 5, August, 1891, 64–65.

[3] The generic name, *Lagurus*, of Gloger (1841), antedates *Eremiomys* Poliokoff (1881) by forty years. For an article on Gloger's names see Thomas, in Annals and Magazine Nat. Hist., Ser. 6, Vol. XV, 1895, pp. 189–193.

the St. Petersburg Museum. At first glance I was impressed by the strong resemblance of this animal to our members of the *pallidus* group; and a detailed comparison of the skulls, teeth, and external characters of the two serves only to confirm this view. They agree in the small flattened skull with squarish, depressed braincase and short nasals; the pattern of the molar teeth (not only the number and relations of the triangles, but also the distant spacing of the loops posteriorly and the appearance of immaturity of the posterior molar in both jaws); the structure of the hinder part of the palate; the short wooly hind feet; the short tail; and even the softness of the polage and pale coloration. In Mr. Miller's specimen the audital bullæ and occipital region are broken off, but on comparing these parts in the Amercian members of the *pallidus* group with Buchner's figures of *Eremiomys* [=*Lagurus*] *lagurus*[4], they are found to be essentially identical. The posterior part of the braincase is not only flattened, depressed and very broad, but the audital and mastoid bullæ are unusually large and the latter project decidedly behind the plane of the occiput. From the close agreement in the above mentioned essential characters, and the absence of important differences, I unhesitatingly refer the American *Microtines* described under the names *Arvicola curtatus, pauperrimus* and *pallidus,* to the Eurasian *Lagurus.* The principal differences are that *L. lagurus* has the tail even shorter than our species, and the ear decidedly smaller. There is also a more or less clearly defined dark streak down the middle of the back that is not present in the American forms.

Lagurus is commonly accorded full generic rank, but I am unable to appreciate more than subgeneric weight in the characters that distinguish it from *Microtus.* Why it has been called a lemning instead of a vole I am not able to understand.

It is gratifying to add another group to the *Microtines* of Circumpolar distribution and at the same time lesson the number restricted to a single continent. *Lagurus* is a Boreal group, finding its southern limit in the Transition Zone.—C. Hart Merriam.

The Introitus Vaginæ of certain Muridæ.—A series of observations made by Mr. G. I. Miller, during the winter and spring months of 1890 and 1891, prove conclusively that in many of the smaller American Muridæ and also in the European *Mus sylvaticus, Evotomys glareolus* and *Microtus agrestis* the vaginal orifice, during pregnancy, lactation and the period of sexual inactivity, is tightly

[4] Przewalski's Reise nach Central-Asien, Säugethiere, liefr. 3, 1889, pl. XIII.

closed by a membrane which resembles a hymen. That this structure is not homologous with the hymen the author has discovered by a histological examination. A series of sections shows conclusively that the vaginal orifice is closed, not, as Lataste states, by the mere approximation of the walls, but by a mass of epidermal cells which is absolutely continuous across the vaginal region. This peculiar epithelial growth does not contain the same histological elements, nor does it occupy the same position as the hymen.

The use of the structure is to protect the vagina from particles of dust, dirt and sand, and probably originated, according to the author, as the result of the action of foreign substances in the vaginal orifice, since mechanical irritation of epithelial tissue causes cell proliferation. This tendency to cell growth in a definite region once established, the protection afforded by it, although incomplete, might offer sufficient opportunity for the operation of natural selection, whereby the definite and useful structure now present could be perfected. (Proceeds. Boston Nat. Hist. Soc., XXVI, 1895).

Zoological News.—A note published by M. A. T. Rochebrune calls attention to a mollusc with toxic properties. This mollusk is *Spondylus americanus*, found by M. Diguet in Lower California. It emits an odor of sulphurretted hydrogen, strong enough to disgust even a famished creature, so it is never prayed upon for food. M. de Rochebrune has isolated the toxic principle by the Stass method, and has obtained an unctuous olive-green extract with an acrid odor and bitter taste, which produces a burning sensation, and which burns with a vivid yellow flame. .001 gr. kills a frog in 12 minutes, after first producing paralysis. .003 gr. kills a guinea pig in 25 minutes. Chemical reactions indicate that in *Spondylus americanus* there is elaborated a product allied to ptomaines and leucomaines, very similar to muscarine, the toxic product of the mushroom, *Amanita muscaria*, and which M. Rochebrune calls Spondylotoxine. (Revue Scientifique, June, 1895).

The South American Characinidæ collected by C. F. Hart, and presented to Cornell University, comprises 167 species of which seven are new, four of them belonging to the genus Tetragonopterus. The material has been identified by A. B. Ulrey. (Am. N. Y. Acad. Sci. 1895).

A collection of birds made in the Philippine Islands by the Menage Expedition for the Minnesota Academy of Natural Sciences includes 36 new species. These are described by Messrs. Bourns and Worces-

ter (1804) in the first volume of Occasional Papers issued by that institution. Two hundred and twenty-six species are noted as already described, but from localities not previously known. Of these 73 were were found in the Calamianes Islands—all of them identical with species found in Palawan.

M. A. Pettit, having had an opportunity of examining the suprarenal capsules of two adult Ornithorhyncus (*O. paradoxus*) makes the following statements in regard to them. In size and general appearance the suprarenal capsules of Ornithorhyncus resemble those of mammals, while their position, within the posterior extremity of the kidney, is an Avian character. (Bull. Soc. Zool. de France, T. XIX, 1894).

ENTOMOLOGY.[1]

A new Tettix.—In a series of specimens of Tettigidæ received from Mr. J. C. Warren of Palouse, Washington, I find a new form, see Fig. 1, nearly allied to *Tettix granulatus* but having certain recognizable differences as here described.

Tettix incurvatus sp. nov. Resembling *Tettix granulatus* nearly but differing as follows: Average length shorter, more robust, pronotum faintly bulging and deeper over the thorax, lateral angles more pronounced, median carina of pronotum distinctly elevated reaching the maximal height over the shoulders, a small swollen space here intercepting the base leaves the carina just in front sharply compressed, convexly sloping to the front, with a depression on each side—this is barely indicated in *T. granulatus.* Dorsal front and lateral front margin of pronotum encroaching on the head. Face broader, cheeks more swollen. Surface of pronotum densely granulated interpersed with fewer coarse granulations. Color dark brownish fuscous tending to black. In the male the wings slightly over reach the pronotum from ½ to 1 mm.; in the female this condition varies, the wings slightly over reaching the pronotum in some cases, in other individuals the reverse is true. Specimens of *T. granulatus* from Indiana, Illinois and

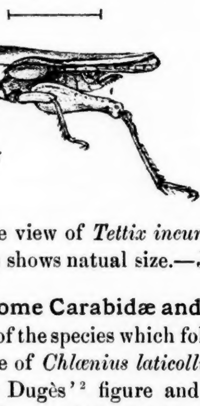
[1] Edited by Clarence M. Weed, New Hampshire College, Durham, N. H.

Massachusetts, in my collection are almost uniformly slender, the pronotum nearly straight toward the front, and the median carina very slightly raised. A series of these examples brought together with the foregoing for comparison are easily separable.

MEASUREMENTS IN MM.

	Length.	Pronotum.	Hind Femora.
♀	14–15	13–13½	6½–7
♂	11–12	10–10½	5½–6

This small locust abounds in openings among pines near the Palouse River, sometimes occurring on moss or white clover. Described from 12 males and 16 females from Palouse, Washington, (collected by J. C. Warren), in the authors collection.



Explanation of Fig. 1. Side view of *Tettix incurvatus* Hancock, enlarged, original, the line above shows natual size.—J. L. HANCOCK.

On the Early Stages of some Carabidæ and Chrysomelidæ.—The descriptions of the larvæ of the species which follow should be compared by the student with those of *Chlœnius laticollis* and *C. leucoscelis* as given by Schaupp[1] and with Dugès'[2] figure and account of *Leptinotarsa lineata*. The details of some of the mouth-parts of the larva of *Cychrus elevatus* are introduced to show the peculiar armature of the mandible.

CYCHRUS ELEVATUS Fabr.

Larva found under a log (in cell, ready for pupation) April 23rd. Color above nearly black, beneath almost white, form robust rather resembling that of some Silphids. Pupated April 25th, pupa of an ordinary Carabidous form and without special marks though the deeply emarginate labrum and expanded tips of the palpi indicated its identity before the beetle was disclosed on the 10th of May. The figures of the mouth

[1] Bull. Brooklyn Ento. Soc., III, 17, 26.

[2] Ann. Soc. Ent. Belg., XXVIII, 1.

parts of the larva are introduced for comparison with those of other Carabids. The mandibles are long and curved, with a very strong tooth near the base, this tooth being pectinate on the inner margin and provided on the side with many short bristles. Still nearer the base of the mandible than the tooth is a bunch of long slender hairs. The maxillæ have only the basal joint left in my preparation—this is heavy and very spiny, bearing near its inner tip a bristle-tipped tubercle. The mentum is broader at tip, the palpi with bristly basal and naked second joint.

CHLÆNIUS SERICEUS Forst.

Larva of a greenish-black color with bronzed luster, head reddish, feet testaceous becoming piceous in the vicinity of the claws.

Form elongate, slightly convex above, more flattened beneath, tapering to both ends but more distinctly posteriorly. The ninth abdominal segment bears two processes or filaments about equal in length to the rest of the insect.

Head narrowed behind the eyes and slightly constricted into a neck; anterior to and between the eyes the upper surface is concave and with two very distinct longitudinal impressed lines. Beneath the surface is convex but with a distinct longitudinal groove and a large anterior triangular impressed space, the middle of which is slightly elevated. The upper and lower surfaces are both very finely granulate, the former with some distinct rugæ and punctures in addition. Hairs are visible only under a strong lens and are few in number.

Ocelli six, about a raised spot back of the antennæ.

Antennæ four-jointed, bristly, the first joint long, the second shorter, third a little longer than the second and bent near the tip. The fourth is scarcely half as long as the third and fusiform in shape.

Mandibles long, curved, armed below the middle with a strong tooth which is directed inwards and downwards; still nearer the base is a small bunch of hairs which lie against each other so closely as to simulate a spine and can only be resolved into components by the use of a high-power objective. This little bunch is, without doubt, the homologue of the large brush found in the larva of *Cychrus elevatus.*

Maxillæ with long stout basal joint bearing a few long spines and numerous more delicate hairs; inner lobe two-jointed, the basal joint the longer and stouter. Palpus four-jointed, first joint short and thick, second more slender and about twice as long, third about equal in length to the second, but more slender, fourth very small. Besides the palpus and inner lobe, the maxilla bears on its basal joint, just near the base of the lobe, a small bristle-tipped appendix of a single joint.

Mentum broader than long, quite bristly, the anterior margin produced at middle and emarginate at sides, the process bearing two long bristles which are approximated at tip and give the appearance of a single long stout spine. Palpi with large basal, shorter second and extremely minute third joint, the basal one alone somewhat feebly spinous.

Prothorax narrower anteriorly, about one-fourth broader than long, lateral and basal marginal lines distinct, anterior margin somewhat broadly depressed, angles rounded; an impressed median line is found, on each side, of which, is a less well-defined slightly oblique channel, deeply punctate at bottom. The whole disk is irregularly punctured, with intervening smooth spaces, the most evident of which are on each side of the above-described lateral grooves.

Meso- and metathorax, taken together, shorter than the prothorax, the impressions similar but broader and less well-defined, the discal punctures with a tendency to coalesce and form transverse rugæ.

Abdomen of nine true segments, slowly tapering, the margins of the first eight paler and apparently somewhat membranous in structure, the ninth bearing a long tubular anal segment and two processes which latter about equal the rest of the body in length and are black with a broad sub-basal orange band. These processes are rather thickly finely bristled and under high power the dark portions give a segmented appearance due probably to the surface being roughened by transverse ridges or scales.

Legs of an ordinary carabidous form—the figure shows a posterior member.

Pupa 10·5 mm. in length, the thorax narrow, with many dorsal bristles, the sides of the abdominal segments somewhat produced as shown in the figure.

The larvæ described were taken in July at Bayfield, Wis., under pieces of wood near ponds. They are hard to rear and only a small proportion could be brought to maturity. If the figures given by Schaupp[3] are correct, the larva of my species differs greatly from his in the immense length of the caudal setæ.

DORYPHORA (Mycocoryna) LINEOLATA Stäl.

Living larvæ cream-colored, pronotum with a yellowish tinge, head of a very light amber, legs black. The mandibles are dark, the tip of the antennæ and a frontal spot in the shape of a broad inverted V are black, as are also the front and hind margins of the pronotum. There is a

[3] Tom. cit. Pl. (I), fig. B.

line of more or less confluent black spots along each side of the body from the base of the pronotum to the penultimate abdominal segment which is dusky over the most of its surface, while the terminal segment is shining and of a deep brown (or occasionally castaneous) color. A black dorsal line extends from near the middle of the metanotum on to the seventh abdominal segment and all the abdominal sutures are edged with black. A more or less interrupted line of brown dots and dashes extends from side to side of each of the first seven abdominal segments and in some cases a similar one occupies the same position on the meso- and metanotum, though they may be reduced to a lateral dot. Form heavy and thick-set much as in the larva of the common *D. decem-lineata;* the prothorax is broader and higher than the mesothorax, the abdomen broadest near the middle. The figure I give is of a specimen in the quiescent state immediately preceding pupation, as all were full grown when mailed to me and changed soon after reception. Length, measured on the chord of the curve 7 mm.

Labrum transverse, rounded in front and rather deep emarginate, the bottom of the margination round. The surface is bristled as shown in the figure.

Ocelli six in number and in two species; the first series, of four, is placed just behind the antenna, the other, of two, immediately beneath that organ.

Antennæ extremely small, short and thick, joints rapidly reducing in thickness.

Mandibles strong, heavy, curved, much flattened, five-toothed at the extremity. Two views are given to show the appearance under different aspects.

Maxillæ about equal to or a little shorter than the mandibles, the inner lobe short and heavy, beset with many spines around the edge. Palpi four-jointed, the first joint very large, the second narrower and shorter, the third again longer, the fourth about equal to the third in length and conical in shape, the tip truncate and beset with very small spines. The bristles on the first, second and third joints are few in number but very stout.

Mentum with the anterior angles turned inward and partially embracing the ligula which is slightly emarginate in front and bears short two-jointed palpi and several spines as figured. In this figure the mentum is drawn under pressure and the angles are everted from their ordinary flexed position.

Legs stout and rather short with a moderate number of strong spines as shown.

The pupa is very robust in form and about 7 mm. in length, the disk of the prothorax bears numerous short bristles, while the sides and dorsum of the abdomen are armed in the same way. The terminal segment bears a short, strong horny spine at apex. The eggs were too much damaged when received to admit of careful description, but were yellow in color and deposited in elongate masses, each egg attached by one end to the leaf of the food-plant, Eggs and full-grown larvæ were sent me by Professor Theo. D. A. Cockerell who collected them at San Augustine Ranch on the east side of the Organ Mountains of New Mexico in August.

State University of Iowa. H. F. WICKHAM.
May 27th, 1895.

EXPLANATION OF PLATE.

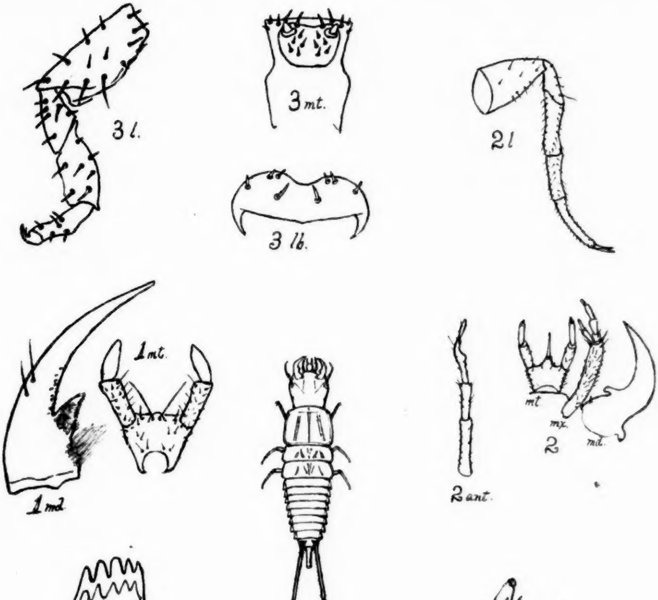
Fig. 1. *Cychrus elevatus* Fabr.
Fig. 2. *Chlænius sericeus* Forst.
Fig. 3. *Doryphora* (*Mycocoryna*) *lineolata* Stäl. All the dissections are lettered alike, ant., antennæ, l. leg, lb., labrum, md., mandible, mt., mentum, mx., maxilla.

Cecidomyia atriplicis [Towsend, Am. Nat., Nov., 1893, gall only] n. sp.— ♀ about 4 mm. long, general color grey ; abdomen blackish above, slightly reddish at sides, presenting, especially towards base, scattered silvery hairs. Ovipositor not exserted. Thorax above leaden-grey, with two distinct longitudinal grooves. Legs and antennæ grey. Eyes black, joining above, almost covering head. Halteres with the stem grey and the knob dull white. Base of occiput with the fringe of hairs. Antennæ with the whorls of hair obscure, 13-jointed, 3rd joint much longer than 4th, but hardly so long as 4–5, which are equal. Joints 4 to 11 decreasing gradually in length ; 12 and 13 very small, looking like one deeply-constricted joint. Wings greyish-white, hardly at all translucent, veins grey, costal vein black, ending abruptly at junction with first longitudinal. Cross nervure slightly oblique, situated almost at base of wing. The anterior fork of the third longitudinal is very obscure, and there is a wing-fold stimulating a third longitudinal, so that the wing seems to have four longitudinal veins, all simple.

Pupa-shell reddish-brown, with the covering of the wings concolorous or rather paler.

Hab. Bred, May 9, 1895, from galls on *Atriplex canescens* collected on College Farm, Las Cruçes, N. M. The galls are red on one side.

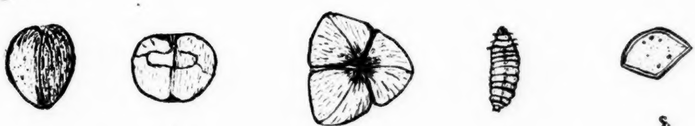
PLATE XXX.



Wickham on Coleoptera.

I am glad to have an opportunity of describing this species, since Prof. Townsend had already named it in connection with the galls.—T. D. A. Cockerell, N. M. Agr. Exp. Sta.

Mexican Jumping Beans.—Occasionally one sees what are known as Mexican Jumping Beans, or Broncho Beans, exposed for sale in curiosity stores, or displayed as objects of interest in drug-stores, or other merchantile establishments. They are usually shown upon some smooth surface, as glass, the face of a mirror, or on the bottom of a smooth box. These beans are able to execute short leaps forward, or even turn over by a side-wise movement. If a dozen are placed in a box, so active are they, that some will be in motion most of the time. They are interesting objects both to grown people and children. Children will watch them by the hour and be amused. They appeal strongly to the sense of the marvelous in older people, who seek a cause for everything, as there is no apparent explanation of these erratic movements. All the risk of dispelling the charm that gives attractiveness to the mysterious, the following explanation of the phenomenon is given.



a b c d e

These animated curiosities are the product of the plant belonging to the Spurge Family (Euphorbiaceæ) known to botanists as *Sebastiania bilocularis.* To this same family belongs the Castor Oil Bean. Therefore it would not seem inappropriate to apply the name *bean* to these saltatorial seeds, though they bear no resemblance in shape to beans belonging to the Pulse Family.

The pods of plants belonging to the Spurge family are usually three lobed, as shown in cut C, and when ripe split up into three triangular valves with a rounded back as shown in cuts *a*, dorsal view, *b* face view, and *e* cross section. Each valve contains a single seed. It is to this tripartite form of the pod that the name Jumping Bean is applied. The plant they are obtained from has quite a wide geographical range, but the saltatorial seeds are found only in a limited area in *Sonora*, Mexico. Some of the seeds do not possess jumping powers and the active ones have to be selected. They are gathered by boys and find ready sale to travelers and dealers in curiosities. These diminutive " Bronchos " are

advertised to continue their antics for about nine months. This is approximately correct. If some of them are put in a box and examined the following season their movements will have ceased. Small holes will be found in the seeds as though something had gnawed out. In the bottom of the box small moths will be found. If the beans are opened while still active in each one will be found a worm or larva snugly tucked away in the interior. One of these larva is shown in cut *c* natural size. The worm is pale yellowish with a brown head, which has a triangular darker patch in the middle, and black mouth parts. There are eight true legs, six anterior and a single pair posterior and four pairs of false feet, pale pink at the ends. There is a pale brownish stripe down the back. Our specimens were examined November 1st. The seed was entirely eaten, the pod only remaining, cut *e* shows a cross section of one of the beans, the dotted portion was eaten. The worm was plump and fat, evidently having relished the oily seed, a taste we can hardly appreciate if the oil of these seeds has the some flavor and properties as Castor Oil. If these larvæ remain active until next summer they will have to live a long time on their accumulated fat, as their food supply was exhausted November 1st. Possibly their restlessness may be the throes of hunger. They probably go into the quiescent or *pupa* state before winter and remain inactive until time to transform the following summer. The worms do not entirely fill the space that was occupied by the seed and by suddenly changing their position they are able to give movements to the light seed pods they occupy. If the seeds are disturbed the worms become quiet for a time. This is an inborn instinct for self-preservation, like that of feigning death, so common among insects.

These worms in due time change to the *pupa* state and finally emerge as small *moths* belonging to the order *Lepidoptera*, Family *Tortricidæ*, which embraces the *Codling Moth* and a host of other small moths many of which are more or less injurious. This species is known to entomologists as *Graptolitha sebastianæ* Riley.

We presume the moths lay their eggs in the young growing pods, as their is no evidence in the mature pods of the method of entrance. The eggs hatch and the young worms feed upon the developing seed and finally spend the winter in the cavity thus formed. They finally change to the quiescent stage and in due time transform to moths gnaw out and are ready to lay eggs again, thus completing the cycle of life. That which appears marvelous often becomes common place when viewed by the light of some natural cause. But the life history of this insect regardlesss of the movements it causes in seeds is interesting, illustrat-

ing as it does the wonderful provision made by host plants to entertain and preserve the parasites that infest them.—F. L. HARVEY, Orono, Maine.

EMBRYOLOGY.[1]

Half Embryos versus Whole Embryos.—In a brief contribution to the Anatomische Anzeiger Dr. T. H. Morgan makes an important advance toward the comprehension of the much vexed question as to what may arise from part of an egg, a part or a whole embryo.

Roux claimed that when one of the first two cells of a cleaving frog's egg was killed by a hot needle, the other cell formed only half an embryo. Hertwig, however, in repeating these experiments obtained whole embryos of small size. Then Born showed that when a frog's egg is fixed upside down, the contents rotate and become differently arranged. Finally O. Schultze has shown that if the egg is fixed upside down in the two-celled stage, it will form two embryos, each of half the normal size.

With these facts in mind Morgan repeated the experiments of Roux and Hertwig to see if the contradictory results might not be due to their having overlooked an important factor, namely, the *position* of the cells.

The results obtained are that when most of the 155 eggs were fixed upside down, six half embryos and two whole embryos were reared, eight in all. Of these, the six half embryos came from the few eggs that were fixed in the normal position, that is, with the black part of the egg uppermost. The two perfect, but half sized embryos, came from the large number of eggs fixed upside down, or with the white side uppermost.

In another set of experiments subsequently undertaken, five half embryos were formed from 92 eggs kept in the normal position. In another case from 125 eggs fixed upside down seven whole embryos and three half embryos were obtained.

It seems that in all the eggs tried, half embryos resulted when the egg was fixed in the normal position and one of the first two cells killed. On the other hand, in most cases tried, small whole embryos were

[1] Edited by E. A. Andrews, Baltimore, Md., to whom abstracts, reviews and preliminary notes may be sent.

formed when the egg was fixed upside down and one of the first two cells killed; in some cases, however, half embryos were formed even under these conditions.

The advance made lies in recognizing that results obtained are not final till all the conditions of the experiment are considered, and that the state of the egg determines the development of half or whole forms irrespective of theories of post-generation or qualitative-division.

The Mouse's Egg.—Dr. J. Sobotta, of Berlin, contributes to the May number of the Archiv für Mikroskopische Anatomie a fully illustrated account of his researches on the fertilization and cleavage of the mouse's egg.

His work has been extended over five years and has involved the death of 750 mice yielding 1459 eggs, only 57 of which were degenerate or not fertilized.

While still warm the ovaries, oviducts and part of the uterus were killed in mixtures of corrosive sublimate and picrosulphuric acid or, to even better advantage, in osmic acid mixtures. The entire organs were cut into serial sections about 10 microns thick, and fixed and stained by special methods given in detail in the paper, to which the reader is referred for a full account of the technique employed.

The author discovered that in the mouse there is besides the period of heat occurring just after parturition, as in many mammals, a second period twenty-one days later. At this time the young are weaned, and by permitting fertilization at this second period only the young are saved for future experiments, whereas they perish if the mother becomes again pregnant at the first period. The ages of the embryos obtained were most accurately determined by reckoning from this second period of heat, at which time the male was admitted.

Ovulation takes place at the first period whether copulation is effected or not. Between the periods of heat copulation is prevented by the fact that the walls of the vagina are grown together.

The process of copulation lasts but one minute and is difficult to observe even in the most tame of the white mice that the author had, as it takes place in the night towards morning, and the animals are then shy. In this process the uterus becomes very greatly distended with sperm containing clusters of sperms and also some isolated sperms, all moving in the liquid. The vagina is distended by a large mass of a homogeneous secretion of the seminal vesicle of the male.

Twenty to thirty hours after copulation the vaginal plug softens and falls out; before this the uterus has become small again and the sperms are dead, as they live but a few hours.

It appears that only a few single sperms enter the oviducts to meet the eggs, since when a sperm was found entering an egg no others could be discovered anywhere near.

When the egg bursts out of a Graafian follicle in the ovary, it is accompanied by a large mass of cells of the discus proligerus that may continue to surround it till after fertilization. It is probable that some of the liquid in the capsule enveloping the ovary and mouth of the oviduct passes into the oviduct with the egg, for the egg is found in a part of the tube distended with liquid.

The egg of the mouse is exceedingly small, only 59 microns in diameter, and is again remarkable amongst Mammalian eggs in having a very thin, flexible zona, only 1½ microns thick.

The polar bodies are exceptionally large, as much as 16 microns through. One is formed while the egg is still in the ovary, it may divide into two, but this was seldom seen. In fact in nine-tenths of the eggs observed only one polar body was formed. Without any other apparent difference some eggs give rise to two and some to one. Since the size and character of the spindle seen in the formation of the single polar body is the same as that seen in the second one when two are formed, it is inferred that most of the eggs omit the formation of the first polar body. In forming the polar body the egg nucleus changes into an achromatic spindle, of probably only 12 threads, lying tangentially near the surface of the egg and bearing probably 12, at the most 14 or 15 rod-shaped chromosomes. There is no sign of radiations in the protoplasm nor of the existence of a centrosome. This spindle then turns into a radial position and the chromosomes divide into two groups of each apparently 12 rounded chromosomes that move toward the ends of the spindle. One group enters the large polar body that is pinched off about it. When there is but one polar body (and is the second if there be two) there are marked thickenings of the achromatic threads to form conspicuous rounded bodies lying in the position of an equatorial plate.

When the polar body is formed the remaining nucleus of the egg forms a dense mass of chromatin about the same size as the male pronucleus. This is formed from the head of a sperm that enters the egg and becomes a spindle-shaped, dense mass lying tangentially near the surface. A centrosome is now seen lying near the male pronucleus. Both pronuclei enlarge and exhibit remarkably large nucleoli or dense spherules of chromatin; there is but one of these in the male while there may be several in the female. Finally all differences between the two nuclei disappear, they lie side by side and each contains a long, much bent strand of chromatin apparently without a free end.

The union of the pronuclei is a summation of separate chromatin bodies that pass from each nucleus to the equator of a spindle; the nuclear membranes disappear and the chromatin breaks up finally into V-shaped loops, apparently 12 in each nucleus; between the nuclei a centrosome is seen surrounded by sharp radiating lines, while there are also radiations in the protoplasm about the nuclei; two centrosomes are next found at the ends of a small spindle lying between the two sets of chromatin loops; these loops then collect at the equator of the spindle that enlarges to form the first cleavage spindle; these chromatin loops are entirely different in size and form from the chromatin bodies seen in the formation of the polar body and appear to be not more than twenty-four in number.

The first cleavage results in the formation of two entirely equal cells. The nucleus of each receives some of the above chromatin loops; the author supposes they split so that each cell receives 24 chromosomes, but this is not evident from his figures and seems rather an inference from a general idea supported by his belief that the adult tissues of the mouse apparently show 24, and the spermocytes as well as the maturing egg 12 chromosomes.

The subsequent cleavage taking place as the egg passes toward the uterus is at first unequal in that one of the cells enlarges and divides into two; there are then three cells, one large, a pair of smaller. The larger then divides into two smaller than the first formed pair. The first formed then divide so that there are now six; then the others divide and the egg is made up of eight all essentially alike. The egg has 16 cells about 72 hours and comes into the uterus about 80 hours after coitus.

If the eggs are not fertilized, either from the lack of copulation or from the fact that not enough sperm enters the oviduct to fertilize all the eggs, they degenerate without cleaving.

Interesting cases of polyspermy were seen to result from a second copulation; if when the vaginal plug is fallen out a second male be admitted, the usual changes in the uterus take place. In one case when the second copulation occurred 18 hours after the first, a sperm was found in an egg having two normal pronuclei, and in another a small pronucleus in addition to the two normal ones. In another case of copulation 24 to 36 hours after the first, where the eggs had divided into two cells, two sperms were found in one cell of one egg and a large nucleus (apparently a male pronucleus) in a cell of another egg, in addition to the normal nucleus of the cell.

PSYCHOLOGY.[1]

The Problem of Instinct.—The works of Prof. Lloyd and of Prof. Baldwin, which I have recently reviewed in these pages, deal more at length with this problem, but it seems worth while to add an account of a very interesting article which Louis Weber published in the January number of the "Revue de Metaphysique et de Morale," pp. 27–59.

The word instinct may be taken in three quite distinct senses. In the first sense it is practically equivalent to animal mind or intelligence; in the second it denotes certain types of conduct, adapted to an end, constant throughout the individuals of a given species or race, and although constant, not dependent upon consciousness for their performance; in the third it denotes simply unconscious adaptation to an end —the instinctive act may be conscious but in that consciousness there must be no representation of the end to which it tends. The first is too vague, the second is arbitrary in that it involves the assumption of a precision that does not exist, the third is preferable to either of the others, for it embraces phenomena of widely different character and recognizes instinct as a phenomenon co-extensive with mentality. The facts accumulated by investigators in this field have been of little value to science for lack of approved methods of research and the theories based upon them stand in need of critical revision.

The difficulties of getting exact information upon these points are great. Unlike physical phenomena, mental phenomena are not objects of direct perception but must be inferred from external signs. In the process of inference many errors creep in, springing, in part, from theological or philosophical prejudices, and in part from our natural tendency to read our own experiences into the minds of the lower animals. Among the most misleading of the anthropocentric conceptions to which this tendency gives rise, is that of the scale of intelligence, in which the human mind has the first place, every other type of mind having its appropriate niche below it. "Thus, the conceptions of relative value, of degree, and of hierarchy are intruded into the study of phenomena which from their very nature cannot be brought under any scheme of classification based upon the notions of less or more."

[1] This department is edited by Dr. Wm. Romaine Newbold, University of Pennsylvania.

Their points of difference are essentially qualitative and cannot be estimated as quantities or magnitudes.

One convenient method of avoiding such illegitimate interpretations is found in the careful study of the physiological conditions of consciousness. We are justified in assuming that sense organs of the same character mediate sensations of the same kind, and if we find any wide difference in the structure of the organs we must be cautious in our interpretations. It is probable, for example, that the conscious states mediated by the composite eye of the insect cannot be translated into any terms drawn from our visual consciousness. It follows, then, that to the bee or the fish, the hive and the water is not at all like that which we understand by those words. And the same is true even of that most general condition of all perception—space. It is probable that few animals have what we know as space, yet all probably have some analogue which bears to their total consciousness the relation that space bears to ours.

Similar inferences may be drawn with reference to common or bodily sensation. As it depends upon bodily structure we can scarcely suppose that the body of an insect yields a sensation-total to its possessor at all like that which our body yields us, and since emotions depend upon variations in the composition of this bodily sensation, we cannot assume that the ant, when he attacks or runs away from his enemy, experiences what we call fear or courage. Yet he experiences analogous emotions.

A careful description of the phenomena of organization and life from the biological or external point of view must, therefore, precede any attempt at an interpretation of their psychological significance, and, as the former has never been done, the attempts made at the latter are of little value. Especially must we discard the current antithesis between "human" and "animal" psychology. As there is no structure common to all "animals," so, too, is there no mind common to all animals. If we are to draw antitheses at all, it would be better to speak of the "insect mind," the "vertebrate mind," since the gulf between the human mind and that of other vertebrates is probably not as great as that between the mind of vertebrates and that of insects. We must, in other words, study morphological types of mind, just as we study similar types of body.

While the method above outlined has not been followed, and the nature of the sensibility of the lower animals has, in consequence, never been thoroughly understood, their acts have been very carefully studied. Unfortunately, the inquiry has been prosecuted from the

more complex to the more simple instead of in the reverse direction, and consequently we find the characteristics of the more complex types ascribed to the acts of animals in general. These traits are finality, or conduciveness to an end, uniformity, and automatic fatality. These, therefore, have been grouped together and termed instinctive, in the narrower sense of the word.

At this point philosophy stepped in and brought the problem into its present shape. The first of the three traits, conduciveness to an end, seems to show an affinity to intelligence; the other two, uniformity and automatic fatality, would put instinct in the same category with mechanisms. And the efforts at explanation proposed show the difficulty of reconciling these conceptions. Thus Hegel terms it an unconscious activity tending towards an end; Schopenhauer, the universal will not yet become clearly self-conscious; Hartmann, instinct is the Unconscious. Montaigne identifies it with intelligent reason, while Descartes claims that it has no mental existence whatever. The most interesting of these theories, however, are those which not only recognize the existence of mental elements in the instinctive act, but endeavor to determine their character. All agree in interpreting them, after the analogy of our own innate and habitual acts, as involving desires, appetites, a vague sense of discomfort, without clear consciousness of the end or volition to realize it, followed, when the end is gained, by subsidence of desire and a sense of comfort, repose, equilibrium. No detailed criticism of this interpretation is necessary; it is enough to say that it rests upon our own experience alone and must not be regarded as more than probably correct.

The above theories deal with the nature of instinct. When we turn to its mode of functioning, we find that the explanations proposed largely depend upon the theories formed of its nature. The only one that need engage our attention at present is that which explains instinct by the analogy of habit. Its functioning, then, depends upon the existence of certain preformed tendencies to act, ingrained in the nervous system of the animal; the start is given by appetite, blind impulse, the painful feeling that drives an organism to movement in conjunction with the external impressions which fire the mental mechanism. Thus, the instinctive act arises as the joint product of nervous organization and environment.

It is evident that this theory stands in need of some account of the manner in which the nervous organization has been got. The explanations proposed fall under three captions: those that ascribe the origin of instinct to more simple phenomena, explicable upon purely

mechanical principles; those that admit a mental source; and those that admit both. According to the first, instinct depends upon habit; according to the second, upon selection; according to the third, upon both. The common point of departure of all these theories is found in the generalization of habit and memory and their union in the conception of heredity. Habit is not limited to the individual but its results are inherited by descendants.

As the type of the mechanical theories, we may take that of Spencer. Instincts are due to complications of reflexes, and this complication is simply an illustration of the most general law of evolution, which involves progressive increase in heterogenity and complexity of correspondence. But this is merely a statement of a fact and not an explanation of it. We wish to know the reason why, and the method in which this complication takes place.

The mental theories fall into two classes. The one, represented by that of Lewes, regards the instinct as a degraded form of intelligent act. This doctrine is discredited by the fact that it would require the parallel assumption that the nervous system of the lower animals is degraded from a more complex form capable of manifesting the higher forms of intelligence. The second class, represented by that of Fouillée, merely translates into mental terms Spencer's mechanical notions. Mind stuff takes the place of Force, but the details are essentially the same, and again the question arises, how and why can combinations of mind stuff bring about the new creations which we see?

None of these theories afford any true explanation of the phenomena. They bring to view the points of resemblance and difference between the instinct, the reflex and the voluntary act, but they do no more.

But the most interesting of the questions that arise in connection with instinct is that of its mode of development. For the solution of this problem we are indebted to Darwin, who has shown that it is due to variation and selection. Yet it should be noted that this does not reduce the development of instinct to a purely mechanical process, which was Spencer's error. The variations are not physical so much as mental, nor are they absolutely predetermined. The conditions that make them possible must be given, such as antecedent and concomitant mental states, but this does not determine their occurrence, since they may or may not occur. If they occur, the organism adapts itself to its environment and survives; if not, it does not adapt itself and becomes extinct. This introduces the last question to be considered, that is, what is the character of these mental variations that underlie the development of instinct?

In the human being we recognize as instinctive the impulsive acts, which fail to present any distinctively voluntary character. Some appear to spring from an unconscious or involuntary tendency, others exist as elements of which the actor has no knowledge, others seem to result from some innate predisposition. To this class a large majority of all our acts belong. When we come to examine it more closely we find that the class contains two groups: the one includes those acts which contain no new element, but are mere repetitions of former acts. These are our habits, innate predispositions, ordinary operations of intelligence, *a priori* intuitions of sense, *a priori* forms of the understanding, etc. All such processes have somewhat in common with instinct, and in common speech the word is often used of them. The other group, while closely akin to these, differs from them in that it contains a new element. Yet they have little in common with the clear volitions and deliberations with which we associate the notion of a new discovery. Few discoveries have, in fact, been so originated. They have rather been the results of a blind impulse, a feeling after the novel, which we can see throughout the animal world, and which has little in common with deliberate will. "Thus, when one says that the human mind has been shaped and enriched by discovery (*invention*), one means that all the modes in which its activity develops are not primary data, of extrinsic origin, but productions of that very activity. Discovery is then neither reason, liberty, religious faith nor conscience; it is not because we are reasonable, free, religious or moral, that we have so progressed and distanced the lower animals, but because we have discovered or created reason, liberty, religion and morality. Why? We do not know, and never shall know. How? It is for sociology and psychology to give us partial answers. Discovery is not an entity. Its concept resolves itself into that of the possibility of real action and of active mental change, and it simply indicates the point at which becoming takes the place of repetition."

The power of discovery is not peculiar to the human race. It requires no high degree of consciousness or power of reflection. It is a blind impulse, found in all animals and the new elements gained by it are concreted and amalgamated by habit and memory into what we see and call instincts.

Thus far, Weber. The affinity between his thought and that of Baldwin is evident; the two classes into which Weber divides the more vague acts, *habitudes* and *invention* are clearly equivalent to Baldwin's Habit and Accommodation. But Weber contents himself with a simple *nescio* at the very point upon which Baldwin has done the best work, that is, How is Accommodation possible?

ANTHROPOLOGY.

Notes taken upon an Exploration of the Lehigh and Susquehanna Valleys for the University of Pennsylvania, in the Summer of 1892.—A careful examination of the Susquehanna region showed that there were no caves available for exploration on the river side, between Pittston and Harrisburg. Many of the caverns reported as light, dry and spacious, were rifts, not large enough to stand in, or did not exist at all. The rocky ravines of the tributaries of the Lehigh in Monroe County were equally unproductive, and though there, and along the Susquehanna, the sandstone was not adapted to the formation of caverns, there seemed at first no reason why preprecipitous cliffs should not have exposed rock shelters, such as characterize the sandstone region of the upper Ohio.

A day was lost at the rock shelter in a steep hillside near Stemlersville, Monroe County, Pa., about 6 ft. long, 8 ft. wide, and 5 ft. high, though tradition said that Indians had made the place and lived in it. Forty years ago, a man, having walled it in, had used it as a sheep pen. Nevertheless, it appeared that beyond a chance night's lodging for the passing tramp, it had probably never served as a shelter for humanity, and when we had removed a large fragment of rock on its floor and dug down two feet without finding any trace of charcoal below the surface, we abandoned the place.

It took half a day to find Girty's Cave in the sandstone cliffs along the Susquehanna, above Klemson's Island, said to have been the hiding place of Simon Girty, the ferocious Indian renegade of the last century. It was the one and only cave on that river, following the east branch from Wyoming to Harrisburg, after the shelter on the bluff, under the Shekillemy Hotel at Sunbury, had been blasted away by a railroad. Mr. McCalvey, of Girty's Notch, had to go with us to the cave, and to find it climed up a series of perpendicular ledges, said to be inhabited by rattlesnakes, overhanging the "river road." Evidently he had forgotten the site himself, for it took half an hour's search to discover it closed by a fallen rock. The evil reputation which Girty's name had given the place in the last century had been increased by events in recent years, and our guide, descending the cliff, told the horrible story of the decomposed body of a murderer long concealed in the hole, and which he had helped to find a few years

before. The cramped inaccessible rift, only large enough for entrance on hands and knees, could have been no fit shelter for man, and even if animals had chosen it for a den it had no more interest for archæology than the so-called "Indian Cave," on a mountain top near Hunlock's Creek, on the right bank of the Susquehanna in Luzerne County, Pa. There two spacious caverns were reported, but the man who led us over the bramble-covered rocks, haunted by rattlesnakes, could only find one. This was a damp, drafty fissure between large, loose blocks of sandstone. Perfect specimens of Indian earthenware have been found hidden in the crevices of rifts like this, and we hoped to have found a hidden pot, but the place was too far from water and too difficult of access to have presumably served as a primitive habitation, and we were not surprised to find no underground relic of man's occupancy when we dug down into the black mold of its floor.

A century of weather and original rough usage seems to have played such havoc with the pottery of the Pennsylvania Indians that scarcely anything is left but small sherds. If it had not been for the habit of the white man's predecessor of placing pots in small caves and rock rifts for safe keeping, we should have few earthern specimens left perfect enough to show what the old forms were. Scarce as Indian graves are in the east Apalachian region of Pennsylvania those containing perfect pots are still scarcer. As a great rarity, the Wilkesbarre Historical Society shows an almost complete pot, found by John Kern in an Indian grave on the Susquehanna River at Plymouth, near by, and another unearthed on the neighboring Kingston Flats, by Millard P. Murray; but one of their best specimens is that found on a ledge in a cave near Tunkhannock, by Asa Dana, in 1858. Mr. A. F. Berlin, of Allentown, informs us that another perfect pot was found recently, as if hidden by an Indian in precolonial times, on the shelf of a sandstone rift on Indian Mountain, near Kresgyville, Carbon County, Pa., by Alfred Keppler.—H. C. Mercer.

SCIENTIFIC NEWS.

Professor Thomas Henry Huxley died at Eastbourne near London, June 30th. Professor Huxley was born in 1825 at Ealing, Middlesex, England. He was educated at Ealing School, of which his

father was one of the teachers. At the age of seventeen he entered the Charing Cross Medical School, and after three years of severe study he graduated with the degree of Batchelor of Medicine, taking high honors in physiology. He entered the navy as an assistant surgeon in 1846, and was appointed to H. M. S. Rattlesnake, Captain Stanley, which sailed the same year on an exploring expedition in the South Pacific and Torres Straits. He collected a great number of specimens and wrote several admirable papers, which he sent home, and which were published after his return in 1850 on the Philosophical Transactions of the Royal Society. His theories excited much interest among that scientific body, and he was in 1851 elected a fellow, which, when conferred on so young a man, was a tribute to talent and learning.

He resigned his navy appointment in 1853, and succeeded Professor Forbes in the chair of natural history in the government School of Mines. Besides this he was connected with other institutions as instructor and lecturer. From 1863 to 1869 he was Hunterian professor in the Royal College of Surgeons and served twice as Fullerian professor of physiology to the Royal Institution. His time was constantly devoted to researches in science, particularly zoology, to advance which he contributed as much as any other contemporaneous investigator. He was a warm friend of Professor Tyndall, and travelled with him over the Alps in early life. The friendship formed in early life continued until death.

The name of Professor Huxley came prominently before the public in 1870 in connection with the London School Board, to which he was elected in that year. In the deliberations of the Board he was especially prominent as the fierce opponent of denominational education, and was particularly conspicuous by his fiery fulminations against the doctrines of the Roman Catholic Church. He retired from the Board in 1872. In the same year he was elected Lord Rector of the University of Aberdeen, and was installed in 1874. On the death of Frank Buckland, in January, 1881, he succeeded that indefatigable naturalist as Inspector General of Fisheries, a position which he filled with his accustomed energy, ability and zeal.

His essays and memoirs were principally contributed to the Journals and Transactions of the Royal, the Geological, the Linnæan and the Zoological Societies. He is the author of "Oceanic Hydrozoa" and "Man's Place in Nature," 1863; "Lectures on Comparative Anatomy," 1864; "Lessons in Elementary Physiology," 1866; "An Introduction to the Classification of Animals," 1869; "Lay Sermons, Addresses and Reviews," 1870; "Manual of the Anatomy of Vertebrated Animals,"

1871, and later of a Manual of the Anatomy of the Invertebrata; and "Critiques and Addresses," 1873.

On the death of Mr. Spottiswoode in 1884, Professor Huxley was elected President of the Royal Society.

Professor Huxley was a skillful taxonomist, and on the whole the best that England has ever produced. His conclusions in this direction have in many instances met with general acceptance, and there was never any difficulty in understanding exactly what he intended to present. His mind was clear, and his method of presentation equally so. He elucidated every subject which he investigated.

The same clearness and logic were apparent in his treatment of philosophical questions. He was one of that class whose reflective powers were equal to those of observation. While exposing obscurities and inconsistencies in popular beliefs, he showed his superior self control and intellectual honesty in that he did not make assertions as to matters on which the evidence is insufficient. Hence in theology, while declaring himself a free-thinker, he did not deny the possibility that some popular beliefs might be true. For this attitude of mind he proposed the term "agnostic," a word which expresses the ignorance of the honest thinker with regard to questions, which lack of sufficient evidence renders at present insoluble. His care not to overstep the boundaries of knowledge in any direction was admirable, for thus he left the door open to progress in all directions.

An authorized edition of the works of Huxley, in nine volumes, is now in course of publication. In this edition his essays are collected under various heads, each of which gives its title to a volume. The fourth volume is entitled "Science and Hebrew Tradition," and has a preface written for it by the author, in which he gives his statement of what is the object of the essays and what he supposes they establish:—

"It is becoming, if it has not become, impossible for men of clear intellect and adequate instruction to believe, and it has ceased or is ceasing to be possible for such men honestly to say they believe, that the universe came into being in the fashion described in the first chapter of Genesis; or to accept as a literal truth the story of the making of woman, with the account of the catastrophe which followed hard upon it, in the second chapter; or to admit that the earth was repeopled with terrestrial inhabitants by migration from Armenia or Kurdistan, little more than four thousand years ago, which is implied in the eighth chapter."

Dr. Lewis Janes, President of the Ethical Society of Brooklyn, with

the assistance of Miss Sarah J. Farmer, of Eliot, Maine, called a conference of evolutionists to meet at the place mentioned. Eliot, Maine, is situated near the N. bank of the Piscataquay river, and is surrounded by white pine forest and cultivated land. The following is the program of exercises.

Saturday, July 6, 1895, 3 p. m.—Welcome to Greenacre, Miss Sarah J. Farmer; opening address, Professor Edward D. Cope, Ph. D., of the University of Pennsylvania, "The Present Problems of Organic Evolution"; 8 p. m.—Paper from Herbert Spencer, London, England, "Social Evolution and Social Duty;" to be followed by a symposium of letters and brief addresses; Monday, July 8th, 3 p. m.—Mr. Henry Wood, Boston, Mass., "Industrial Evolution;" 8 p. m.—Mr. Benjamin F. Underwood, Editor *Philosophical Journal*, Chicago, Ill., "How Evolution Reconciles Opposing Views of Ethics and Philosophy," letters and brief addresses; Tuesday, July 9th, 3 p. m.—Professor Edward S. Morse, of the *Peabody Institute*, Salem, Mass., "Natural Selection and Crime;" 8 p. m.—Dr. Martin L. Holbrook, Editor *Journal of Hygiene*, New York, "Evolution's Hopeful Promise for Human Health;" Wednesday, July 10th, 3 p. m.—Rev. Edward P. Powell, Clinton, New York, "Evolution of Individuality;" 8 p. m.—Miss Mary Proctor, New York, "Other Worlds than Ours," (with stereopticon illustrations); Thursday, July 11th, 3 p. m.—Rev. James T. Bixby, Ph. D., Yonkers, N. Y., "Evolution of the God-Idea;" 8 p. m. —Dr. Lewis G. Janes, President Brooklyn Ethical Association, "Evolution of Morals;" Friday, July 12th, 3 p. m.—Mr. Henry Hoyt Moore, of the Outlook, N. Y., "Utopias; Social Ideals Tested by Evolutionary Principles;" 8 p. m.—Rev. Jno. C. Kimball, Hartford, Conn., "The World's coming better Social State;" Saturday, July 13th, 3 p. m.—Professor Jno. Fiske, LL. D., Cambridge, Mass., "The Cosmic Roots of Love and Self Sacrifice;" 8 p. m.—Professor Jno. Fiske, LL. D., "The Everlasting reality of Religion."

The Kansas University will have five scientific expeditions in the field this summer. One under the direction of Professor Dyche will go to Greenland to collect natural history specimens. Professor Williston will have charge of the second to collect Tertiary fossils in Kansas and Wyoming. Professor Snow will explore the southwestern States for entomological specimens; while the fifth, under Professor Haworth, will thoroughly overhaul the Cenozoic beds of Kansas.

The Third International Congress of Physiologists will be held at Bern, Switzerland, September 9 to 13th, 1895. Titles of communications may be sent to Frederic S. Lee, Secretary American Physiological Society, Columbia College, New York City.